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# The European Research Journal

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# The Relationship Between Metabolic Syndrome and Urogenital Health Markers: A Cross-Sectional Study

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## Abstract:

**Objective:** Metabolic syndrome (MetS) is a cluster of metabolic abnormalities that increases cardiovascular risk and may adversely affect urogenital function, particularly erectile and prostate-related parameters. To evaluate the association between MetS and urogenital health markers, including erectile function, lower urinary tract symptoms, prostate volume, and internal iliac artery resistive index (RI).

**Methods:** This cross-sectional study included 110 adult men without known cardiovascular, endocrine, oncological, or urological diseases evaluated at a hospital check-up clinic. Participants were grouped according to the presence of MetS. Erectile function (International Index of Erectile Function-5 [IIEF-5]), lower urinary tract symptoms (International Prostate Symptom Score [IPSS]), prostate volume, and internal iliac artery RI were assessed. Group comparisons were performed using non-parametric tests and the chi-square test, as appropriate.

**Results:** Participants with MetS had significantly lower IIEF-5 scores and a higher prevalence of erectile dysfunction compared with MetS and without MetS ( $P=0.042$ ). Although IPSS scores and prostate volume tended to be higher in the MetS group, these differences were not statistically significant ( $P>0.05$ ). No significant differences were observed in internal iliac artery RI values between groups ( $P>0.05$ ).

**Conclusion:** MetS is significantly associated with erectile dysfunction and may contribute to impaired urogenital health. Internal iliac artery RI alone does not appear to be a sensitive early marker of urogenital vascular impairment.

**Keywords:** Metabolic Syndrome, Erectile Dysfunction, Prostate Volume, Internal Iliac Artery, International Prostate Symptom Score, International Index of Erectile Function-5

Metabolic syndrome (MetS) is a multifactorial disorder characterized by chronic inflammation and insulin resistance. It is closely associated with major causes of morbidity and mortality, including cardiovascular diseases, type 2 diabetes, and various cancers [1]. The core components of MetS are abdominal obesity, insulin

resistance/hyperglycemia, dyslipidemia and hypertension [2]. The effects of these metabolic disorders on male health, particularly their relationship with the urogenital system, have become a growing focus of research in recent years.

The pathophysiological connections among benign prostatic hyperplasia, lower urinary tract

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symptoms, erectile dysfunction (ED), and MetS are becoming increasingly clear. There is strong evidence that MS contributes to erectile dysfunction via endothelial dysfunction, chronic inflammation, and hormonal imbalances [3, 4]. Similarly, it has been suggested that insulin resistance and hyperinsulinemia may trigger the development of benign prostatic hyperplasia by promoting the proliferation of prostate cells [5].

This study aimed to evaluate the relationship between metabolic syndrome and urogenital health markers in healthy men using a multidimensional approach. Clinical symptom scores (International Prostate Symptom Score [IPSS] and International Index of Erectile Function-5 [IIEF-5]), prostate volume, and vascular status assessed by the internal iliac artery resistive index were evaluated in combination. The internal iliac artery resistive index was further examined to explore its potential role as a non-invasive indicator of pelvic vascular status in relation to urogenital health.

## METHODS

### Study Design and Population

This study was designed as a cross-sectional observational study conducted in adult male individuals presenting to a hospital check-up clinic. Data were collected at a single time point. Between January 2025 and May 2025, a total of 147 individuals were initially screened. Exclusion criteria included a history of diabetes mellitus, cardiovascular disease, chronic kidney disease, known prostate disease, oncological disease, prior pelvic surgery, or current use of medications affecting sexual or urinary function. After applying these criteria, 110 adult men were enrolled in the study. All participants provided written informed consent, and the study protocol was approved by the local Clinical Research Ethics Committee (Approval No: 137/2025) in accordance with the Declaration of Helsinki. A flowchart illustrating patient screening, exclusions, and final inclusion is presented in Figure 1.

### Clinical and Laboratory Assessment

Demographic characteristics, including age, body

mass index (BMI), and smoking status, were recorded for all participants. Blood samples were collected in the morning after an overnight fast to measure fasting blood glucose (FBG), glycosylated hemoglobin (HbA1c), high-density lipoprotein (HDL) cholesterol, triglycerides (TG), and total prostate-specific antigen (PSA).

### Definition of Metabolic Syndrome

MetS was defined according to commonly used criteria derived from the American Diabetes Association (ADA) and the International Diabetes Federation (IDF). Participants were classified as having metabolic syndrome if at least two of the following criteria were present: low HDL cholesterol ( $<40$  mg/dL), elevated TG ( $\geq 150$  mg/dL), FBG  $\geq 100$  mg/dL, and/or HbA1c  $\geq 5.7\%$ .

### Radiological Assessment

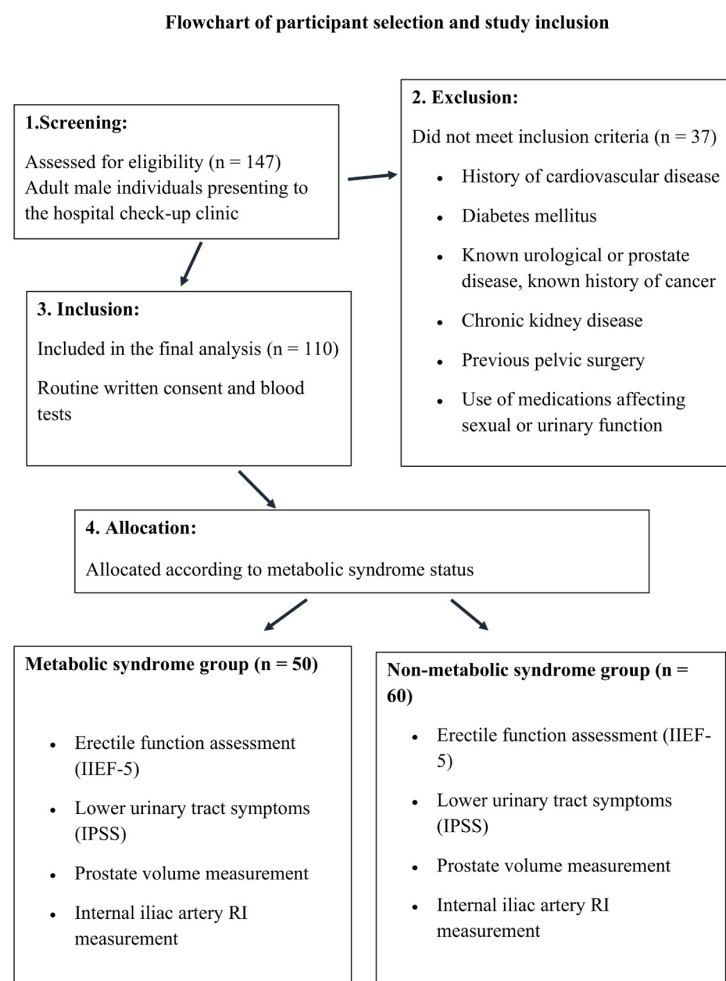
Prostate volume was measured by an experienced radiologist using transabdominal ultrasonography. A prostate volume greater than 25 mL was considered increased. Pelvic vascular evaluation was performed using color Doppler Ultrasound. The RI was measured bilaterally from the internal iliac arteries and calculated as  $RI = (\text{Peak systolic velocity [PSV]} - \text{end diastolic velocity [EDV]}) / \text{PSV}$ . The internal iliac artery was selected as a proximal pelvic vascular marker due to its contribution to both prostatic and penile arterial supply.

### Symptom and Functional Assessment

Lower urinary tract symptoms were assessed using the IPSS, categorized as mild (0–7), moderate (8–19), or severe (20–35). Erectile function was evaluated using the five-item IIEF-5, and erectile dysfunction severity was categorized as normal, mild, mild-to-moderate, moderate, or severe according to established cut-off values.

### Statistical Analysis

Statistical analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed using the Kolmogorov-Smirnov test. Continuous variables with normal distribution are presented as mean  $\pm$  standard deviation, whereas non-normally distributed



**FIGURE 1.** Flowchart of participant selection and study inclusion.

variables are expressed as median and interquartile range. Comparisons between the metabolic syndrome and non-metabolic syndrome groups were performed using the Student's t-test for normally distributed continuous variables and the Mann-Whitney U test for non-normally distributed continuous variables. Categorical variables were compared using the chi-square ( $\chi^2$ ) test. A two-sided P-value  $<0.05$  was considered statistically significant. A post-hoc power analysis was conducted based on the observed difference in IIEF-5 scores between groups. With a total sample size of 110 participants and a two-sided alpha level of 0.05, the study achieved a statistical power of greater than 80% to detect a medium effect size, which indicates that the study was adequately powered for the primary outcome related to erectile function, while non-significant findings for other parameters should be interpreted with caution.

## RESULTS

Data from a total of 110 participants were analyzed. The mean age of the study population was 45.8 years, with a median age of 44 years. MetS was identified in 50 individuals (45.5%), while 60 participants (54.5%) did not meet the diagnostic criteria. Baseline demographic and clinical characteristics are summarized in Table 1. The MetS and non-MetS groups were comparable with respect to age and smoking status, whereas significant differences were observed in metabolic parameters and BMI.

Based on IIEF-5 scores, erectile dysfunction was significantly more prevalent among individuals with MetS ( $P=0.042$ ). In particular, the proportions of mild-to-moderate and moderate erectile dysfunction were higher in the MetS group, whereas the non-MetS group demonstrated a higher prevalence of normal

**TABLE 1. Baseline Demographic and Clinical Characteristics of the Study Population**

Variable	Metabolic syndrome (n=50)	Non-Metabolic syndrome (n=60)	P-value
Age (years)	46.3±8.2	45.4±7.9	0.512
Body mass index (kg/m <sup>2</sup> )	29.1±3.4	25.6±2.9	<b>&lt;0.001</b>
Smoking status, n (%)			0.684
Current smoker	18 (36.0)	20 (33.3)	
Non-smoker	32 (64.0)	40 (66.7)	
Fasting blood glucose (mg/dL)	112 (104–126)	92 (86–98)	<b>&lt;0.001</b>
HbA1c (%)	5.9 (5.7–6.3)	5.3 (5.1–5.5)	<b>&lt;0.001</b>
HDL cholesterol (mg/dL)	38 (34–41)	47 (44–52)	<b>&lt;0.001</b>
Triglycerides (mg/dL)	178 (156–214)	118 (96–134)	<b>&lt;0.001</b>
Total PSA (ng/mL)	0.86 (0.52–1.21)	0.81 (0.49–1.17)	0.614

Data are shown as mean ± standard deviation or median (interquartile range) or n (%) where appropriate. HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; PSA, prostate-specific antigen.

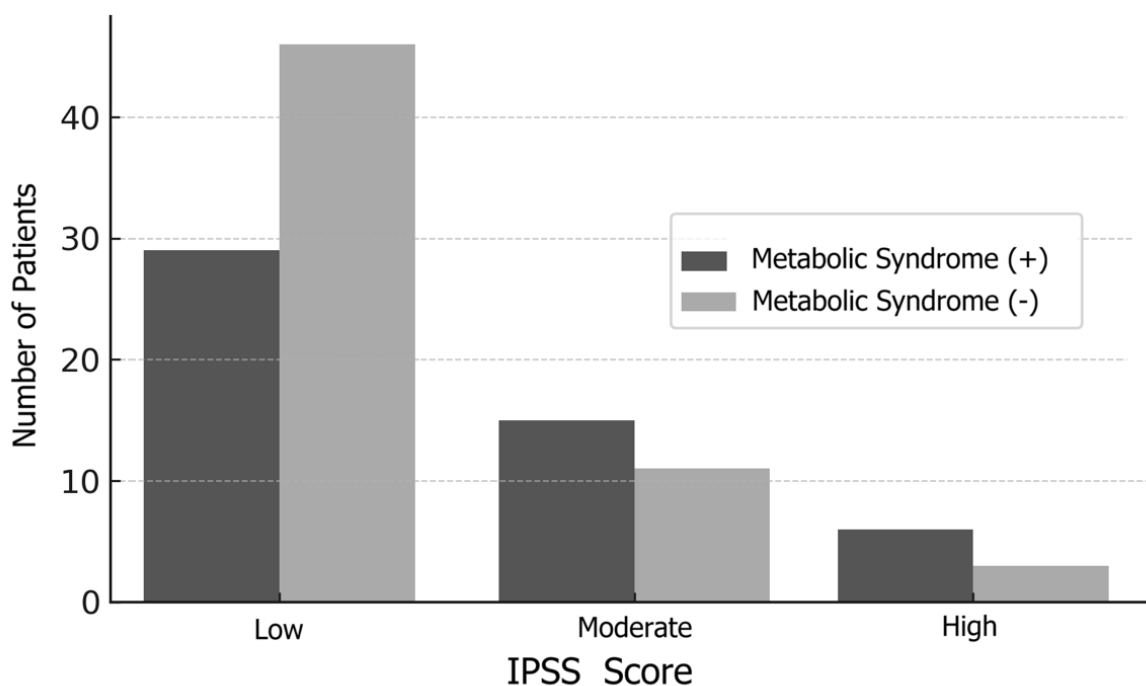
Statistically significant P-values are shown in bold.

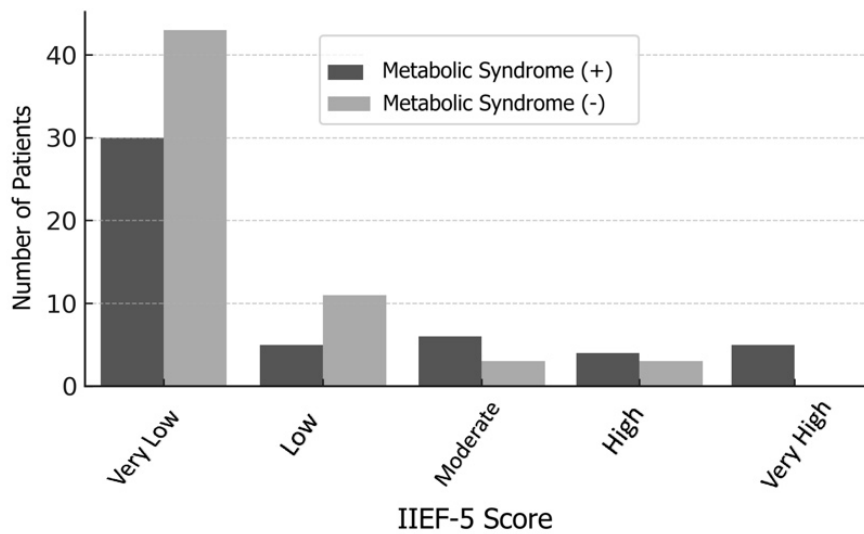
erectile function (Figure 2).

Regarding IPSS categories, severe lower urinary tract symptoms were more frequently observed in the MetS group; however, this difference did not reach statistical significance (P=0.100). Similarly, increased prostate volume- including severe enlargement in five

cases (n=5)- was more common in MetS group, although this finding also failed to achieve statistical significance (P=0.061) (Figure 3).

No statistically significant differences were detected in internal iliac artery resistive index (RI) values between the groups. Median RI values for both

**FIGURE 2. International Index of Erectile Function-5 questions (IIEF-5) scores for patients with and without metabolic syndrome.**



**FIGURE 3.** International Prostate Symptom Score (IPSS) for patients with and without metabolic syndrome.

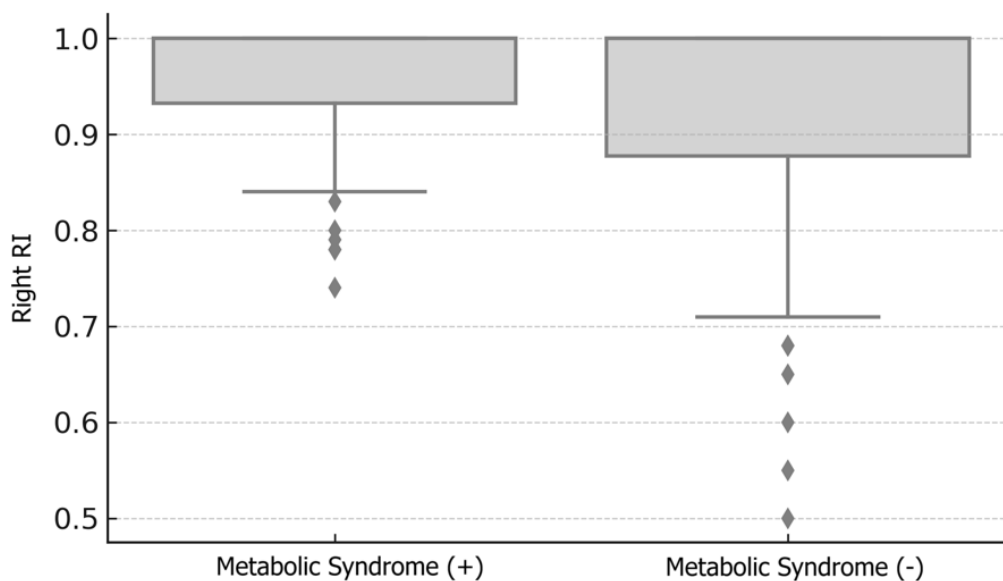
the right and left internal iliac arteries were 1.00 in both groups ( $P=0.479$  for right RI and  $P=0.749$  for left RI) (Figures 4 and 5).

### DISCUSSION

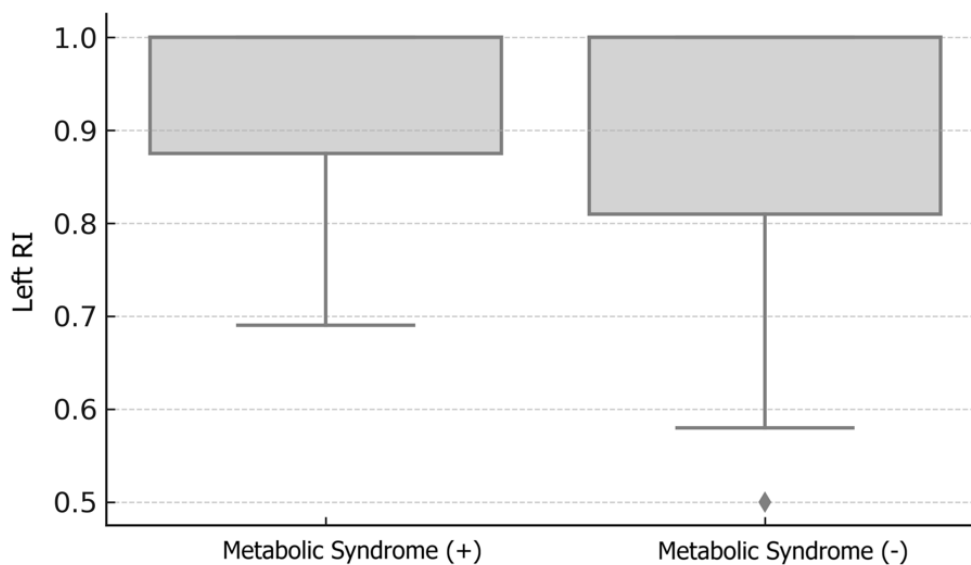
This study examined the association between MetS and several urogenital health parameters, including erectile function, lower urinary tract symptoms, prostate volume, and pelvic vascular indices. The

principal finding was a significant association between MetS and erectile dysfunction, reflected by lower IIEF-5 scores among individuals with MetS. This result is consistent with previous studies demonstrating that MetS contributes to erectile dysfunction through endothelial dysfunction, chronic inflammation, and metabolic and vascular impairment [4, 6].

Endothelial dysfunction plays a central role in the pathophysiology of erectile dysfunction and is closely associated with insulin resistance and dyslipidemia [6-



**FIGURE 4.** Right internal iliac artery resistive index (RI) for patients with and without metabolic syndrome.



**FIGURE 5.** Left internal iliac artery resistive index (RI) for patients with and without metabolic syndrome.

8]. Decreased nitric oxide bioavailability, increased oxidative stress, and altered endothelial nitric oxide synthase activity have been proposed as key mechanisms contributing to erectile dysfunction in men with MetS. In addition, erectile dysfunction has been recognized as an early clinical manifestation of subclinical cardiovascular disease, reinforcing its significance as a systemic vascular marker [9, 10]. Due to the moderate sample size and the strong intercorrelation among metabolic components, multivariable regression analysis to identify independent predictors of erectile dysfunction was not performed to avoid model overfitting and unstable estimates.

In the present study, individuals with MetS demonstrated higher IPSS scores and larger prostate volumes than those without MetS; however, these differences did not reach statistical significance. These results should therefore be interpreted with caution, as no definitive conclusions can be drawn regarding a causal relationship between MetS and lower urinary tract symptoms or prostate enlargement based on the current data. Nonetheless, the observed trends are consistent with previous studies indicating an association between metabolic disturbances, insulin resistance, and benign prostatic hyperplasia [11-14]. The absence of statistical significance may partly reflect the relatively limited sample size, particularly for prostate-related outcomes.

A notable aspect of this study is the evaluation of the internal iliac artery RI as a potential pelvic vascular marker. No significant differences in internal iliac artery RI values were observed between the MetS and non-MetS groups, indicating that this parameter alone may lack sufficient sensitivity to detect early vascular alterations associated with metabolic syndrome. Previous studies have demonstrated that Doppler parameters obtained from more distal penile vessels - particularly the internal pudendal and cavernosal arteries - are more sensitive indicators of early endothelial dysfunction and erectile impairment [15]. As the internal pudendal artery directly supplies the penile vascular bed, hemodynamic changes at this level may precede detectable alterations in more proximal pelvic arteries, such as the internal iliac artery.

Accordingly, the absence of significant differences in internal iliac artery RI values may reflect an early or subclinical stage of vascular involvement in the study population. In addition, RI measurements are affected by several physiological and technical factors, including blood pressure, vascular compliance, and insonation angle, which may further limit their utility as stand-alone indicators of urogenital vascular health. These factors underscore the importance of comprehensive vascular assessment approaches that incorporate both proximal pelvic and distal penile arterial evaluations.

## Strengths and Limitations

This study included a well-defined group of otherwise healthy men, reducing potential confounding effects. Urogenital health was evaluated using clinical symptom scores (IPSS and IIEF-5), prostate volume, and Doppler-based assessment of the internal iliac artery. The sample size was sufficient for the primary outcome related to erectile function.

The cross-sectional, single-center design limits causal interpretation and generalizability. The sample size may have limited the detection of significant differences in prostate-related outcomes. Hormonal parameters were not assessed, and vascular evaluation was limited to the internal iliac artery, which may be less sensitive to early vascular changes than distal penile vessels.

## CONCLUSION

This study demonstrates an adverse association between MetS and erectile function. Although differences in prostate volume and lower urinary tract symptoms were not statistically significant, the observed trends suggest a potential link between metabolic disturbances and benign prostatic hyperplasia. The finding that the internal iliac artery RI alone is insufficient as a marker of urogenital vascular health underscores the need for comprehensive vascular assessment strategies. MetS criteria may therefore serve as a useful framework for identifying individuals at increased risk of urogenital health impairment. Larger, multicenter studies incorporating hormonal assessments are warranted to further clarify these associations.

### *Ethics Approval and Consent to Participate*

This study was approved by the Istanbul Aydın University Non-Interventional Clinical Research Ethics Committee (Decision No: 2025/137; date: 26.06.2025). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Written informed consent was obtained from all individual participants included in the study.

### *Data Availability*

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

### *Authors' Contribution*

Study Conception: FST, GÖ, HCD; Study Design: FST, GÖ, HCD; Supervision: FST, GÖ, HCD; Funding: N/A; Materials: FST, GÖ, HCD; Data Collection and/or Processing: FST, GÖ, HCD; Statistical Analysis and/or Data Interpretation: FST, GÖ, HCD; Literature Review: FST; Manuscript Preparation: FST; and Critical Review: FST, GÖ, HCD.

### *Conflict of Interest*

The author(s) disclosed no conflict of interest during the preparation or publication of this manuscript.

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### *Generative Artificial Intelligence Statement*

The authors declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the authors in accordance with scientific research methods and academic ethical principles.

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## REFERENCES

1. Kassi E, Pervanidou P, Kaltsas G, Chrousos G. Metabolic syndrome: definitions and controversies. *BMC Med.* 2011;9:48. doi: [10.1186/1741-7015-9-48](https://doi.org/10.1186/1741-7015-9-48).
2. Saklayen MG. The Global Epidemic of the Metabolic Syndrome. *Curr Hypertens Rep.* 2018;20(2):12. doi: [10.1007/s11906-018-0812-z](https://doi.org/10.1007/s11906-018-0812-z).
3. Traish AM, Guay A, Feeley R, Saad F. The dark side of testosterone deficiency: I. Metabolic syndrome and erectile dysfunction. *J Androl.* 2009;30(1):10-22. doi: [10.2164/jandrol.108.005215](https://doi.org/10.2164/jandrol.108.005215).
4. Corona G, Rastrelli G, Morelli A, Vignozzi L, Mannucci E, Maggi M. Hypogonadism and metabolic syndrome. *J Endocrinol Invest.* 2011;34(7):557-567. doi: [10.3275/7806](https://doi.org/10.3275/7806).
5. Vikram A, Jena G, Ramarao P. Insulin-resistance and benign prostatic hyperplasia: the connection. *Eur J Pharmacol.* 2010;641(2-3):75-81. doi: [10.1016/j.ejphar.2010.05.042](https://doi.org/10.1016/j.ejphar.2010.05.042).
6. Guay AT. ED2: erectile dysfunction = endothelial dysfunction. *Endocrinol Metab Clin North Am.* 2007;36(2):453-463. doi: [10.1016/j.ecl.2007.03.007](https://doi.org/10.1016/j.ecl.2007.03.007).
7. Guay A, Jacobson J. The relationship between testosterone levels, the metabolic syndrome (by two criteria), and insulin resistance in a population of men with organic erectile dysfunction. *J Sex Med.* 2007;4(4 Pt 1):1046-1055. doi: [10.1111/j.1743-6109.2007.00530.x](https://doi.org/10.1111/j.1743-6109.2007.00530.x).
8. Tousoulis D, Kampoli AM, Tentolouris C, Papageorgiou N, Stefanadis C. The role of nitric oxide on endothelial function. *Curr Vasc Pharmacol.* 2012;10(1):4-18. doi: [10.2174/157016112798829760](https://doi.org/10.2174/157016112798829760).
9. Wei M, Macera CA, Davis DR, Hornung CA, Nankin HR, Blair SN. Total cholesterol and high density lipoprotein cholesterol as important predictors of erectile dysfunction. *Am J Epidemiol.* 1994;140(10):930-937. doi: [10.1093/oxfordjournals.aje.a117181](https://doi.org/10.1093/oxfordjournals.aje.a117181).
10. Yannas D, Frizza F, Vignozzi L, Corona G, Maggi M, Rastrelli G. Erectile Dysfunction Is a Hallmark of Cardiovascular Disease: Unavoidable Matter of Fact or Opportunity to Improve Men's Health? *J Clin Med.* 2021;10(10):2221. doi: [10.3390/jcm10102221](https://doi.org/10.3390/jcm10102221).
11. Gacci M, Corona G, Vignozzi L, et al. Metabolic syndrome and benign prostatic enlargement: a systematic review and meta-analysis. *BJU Int.* 2015;115(1):24-31. doi: [10.1111/bju.12728](https://doi.org/10.1111/bju.12728).
12. Rastrelli G, Vignozzi L, Corona G, Maggi M. Testosterone and Benign Prostatic Hyperplasia. *Sex Med Rev.* 2019;7(2):259-271. doi: [10.1016/j.sxmr.2018.10.006](https://doi.org/10.1016/j.sxmr.2018.10.006).
13. Rohrmann S, Smit E, Giovannucci E, Platz EA. Association between markers of the metabolic syndrome and lower urinary tract symptoms in the Third National Health and Nutrition Examination Survey (NHANES III). *Int J Obes (Lond).* 2005;29(3):310-316. doi: [10.1038/sj.ijo.0802881](https://doi.org/10.1038/sj.ijo.0802881).
14. De Nunzio C, Aronson W, Freedland SJ, Giovannucci E, Parsons JK. The correlation between metabolic syndrome and prostatic diseases. *Eur Urol.* 2012;61(3):560-570. doi: [10.1016/j.eururo.2011.11.013](https://doi.org/10.1016/j.eururo.2011.11.013).
15. Huang WL, Tung SY, Tseng CS, et al. The flow index provides a comprehensive assessment of erectile dysfunction by combining blood flow velocity and vascular diameter. *Sci Rep.* 2022;12(1):16099. doi: [10.1038/s41598-022-19364-5](https://doi.org/10.1038/s41598-022-19364-5).

# Investigation of Changes in Liver Fibrosis Scores and Kidney Function in Patients with Diabetic Hepatosteatosi

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## Abstract:

**Objective:** Hepatosteatosi, diabetes, and chronic kidney disease are significant risk factors for mortality and morbidity. The objective of this study was to examine the relationship between non-invasive liver fibrosis scores and kidney function tests in patients with diabetic hepatosteatosi.

**Methods:** This present study was conducted through a retrospective analysis of two consecutive data sets of 72 diabetic patients aged 18–80 years of both sexes who were investigated for at our hospital between 2018 and 2024. The relationships between hepatosteatosi, diabetes mellitus parameters, kidney function tests, liver function tests, and fibrosis scores (BARD, BAAT, NFS, FIB4, APRI) were examined.

**Results:** Among the patients included in the study, 54.2% (n=39) were female, and the mean age was 60.99±12.46 years. A moderate negative correlation was found between the initial GFR and both initial FIB4 (P<0.001) and NFS values (P=0.001), while a weak negative correlation was observed between the final GFR and both final FIB4 (P=0.016) and NFS values (P=0.001). A weak negative association was observed between the differences in the initial and final GFR values and both the differences in BARD scores and BARD ratios (P=0.039). Linear regression analysis revealed that a one-unit increase in the BARD ratio led to a 4.34-unit decrease in GFR.

**Conclusion:** The study revealed a correlation between fibrosis progression, as measured by repeated measurements, and an increased risk of developing new-onset chronic kidney disease. The findings of this study indicated that liver fibrosis in patients with diabetic hepatosteatosi might contribute to the development of chronic kidney disease, thereby underscoring the necessity for enhanced monitoring of kidney function.

**Keywords:** Hepatosteatosi, Diabetes Mellitus, Liver Fibrosis Scores, Kidney Function

**N**on-alcoholic fatty liver disease (NAFLD) is identified when hepatic fat accumulation (hepatosteatosi) is demonstrated through histological analysis or imaging techniques, in the absence of heavy alcohol intake, steatogenic drugs, or

genetic/metabolic disorders that can result in secondary fat deposition in the liver [1, 2]. Between 1990 and 2006, the worldwide prevalence of NAFLD rose by 50.4%, with reported rates increasing from 25.26% to 38% during 2016–2019 [3]. This steady

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upward trend in NAFLD and hepatic steatosis imposes a growing financial strain on healthcare systems globally [4]. Clinical evidence indicates that steatosis in NAFLD patients can progress to fibrosis and, in certain patients, may eventually result in cirrhosis [5]. Given the morbidity associated with fatty liver disease and the elevated mortality risk linked to cirrhosis, timely detection and management of both the general population and high-risk groups is essential [6, 7]. Although the complications of diabetes affecting the cardiovascular, renal, retinal, and nervous systems are well established [8], the exact nature of its relationship with NAFLD is less well understood. Clinically, this is important since individuals with diabetes face a significantly greater likelihood of developing cirrhosis, with a standardised mortality ratio approximately 2.3 times higher than that of non-diabetic individuals [8, 9]. A strong link between type 2 diabetes and NAFLD has been documented, with liver injury spanning a spectrum from simple steatosis to end-stage cirrhosis.

Chronic kidney disease (CKD) is defined as a persistent reduction in glomerular filtration rate and represents a major global health issue due to its substantial contribution to overall mortality [10, 11]. Cardiovascular disease, metabolic syndrome, and CKD share several overlapping risk factors, including high blood pressure, elevated glucose and triglyceride levels, abdominal obesity, and reduced high-density lipoprotein (HDL) cholesterol [12, 13]. Some studies have suggested that markers of liver fibrosis may be associated with CKD [14, 15], although these findings have not been consistently confirmed in the general population.

The present study aimed to investigate whether non-invasive liver fibrosis (NILF) scores are related to kidney function parameters in patients diagnosed with hepatic steatosis and diabetes mellitus.

## METHODS

This study, which comprised retrospectively reviewed two consecutive data sets from 72 patients aged 18–80 years of both sexes who were referred to our hospital between 2018 and 2024, investigated hepatosteatois, which was detected on abdominal ultrasonography requested due to suspected

hepatosteatois in diabetic patients. The initial parameters were designated as “parameters\_1” and the final ones as “parameters\_2”. The parameters compared during the study included blood urea nitrogen (BUN), creatinine, calculated glomerular filtration rate (GFR), aspartate aminotransferase (AST), alanine aminotransferase (ALT), albumin, total cholesterol, HDL, low-density lipoprotein (LDL), glycated haemoglobin (HbA1c), body mass index (BMI), and liver fibrosis scores including BARD, FIB-4, BAAT, NFS, and APRI.

•**BARD (BMI, AST/ALT Ratio, Diabetes)** is scored as [BMI >28 kg/m<sup>2</sup>] = 1 point, [AST/ALT ratio >0.8] = 2 points, and [diabetes mellitus present] = 1 point. A result for BARD between 0–1 indicates a “low risk”, and BARD between 2–4 indicates a “high risk”.

•**FIB4 (Fibrosis-4)** is calculated as [Age (years) × AST ÷ Platelet count (10<sup>3</sup>/μL) × √ALT]. The result is interpreted as follows: if <1.45” indicates a “low risk”, if between 1.45–3.25 indicates an “intermediate risk”, and if >3.25 indicates a “high risk”.

•**BAAT (BMI, Age, ALT, Thrombocytes)** is scored as [BMI >28 kg/m<sup>2</sup>] = 1 point, [Age >50 years] = 1 point, and [ALT >(2 × upper limit of reference)] = 1 point, and [Triglycerides >150 mg/dL (or >1.7 mmol/L)] = 1 point.

•**NFS (NAFLD Fibrosis Score)** is calculated as [–1.675 + (0.037 × Age (years))] + [0.094 × BMI (kg/m<sup>2</sup>)] + [1.13 × Impaired Fasting Glucose or Diabetes (Yes = 1, No = 0)] + [0.99 × AST/ALT ratio] – [0.013 × Platelet count (10<sup>3</sup>/μL)] – [0.66 × Albumin (g/dL)]. A result <(–1.455) indicates a fibrosis level between “F0–F2”, a result between (–1.455) and 0.675 is interpreted as an “indeterminate level”, and a result >0.675 indicates a fibrosis level between “F3–F4”; where F0 = “No fibrosis”, F1 = “Mild fibrosis”, F2 = “Moderate fibrosis”, F3 = “Severe fibrosis”, and F4 = “Cirrhosis”.

•**APRI (AST/Platelet Ratio Index)** is calculated as [AST (IU/L) ÷ Upper Limit of Normal for AST (IU/L) ÷ Platelet count (10<sup>3</sup>/μL)]. A score ≤0.5 indicates “no fibrosis”, a score >1.5 indicates “significant fibrosis”, and a score ≥2 suggests “advanced fibrosis”

The initial and final values were compared based on correlations between fibrosis scores and GFR. The relationships between the change in initial and final FR and both the change and ratio of liver fibrosis

scores over the same period were also evaluated.

Ethical approval was obtained from the Non-Interventional Clinical Research Evaluation Ethics Committee of Ufuk University (Ankara, Türkiye) at the meeting numbered 24.06.07.02/06, dated 07.06.2024.

### Statistical Analysis

The data were analysed using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY: IBM Corp. USA). Categorical variables were expressed as frequency (n) and percentage (%). The normality of the distribution for continuous variables was assessed using skewness and kurtosis tests, and the results were presented as mean, standard deviation, median, minimum, and maximum values. Pearson and Spearman's correlation coefficients were used for correlation analysis. The effects of independent

variables on dependent variables were evaluated using linear regression analysis. A P-value <0.05 was considered statistically significant.

### RESULTS

The mean age of the patients included in the study was 60.99±12.46 years. Statistically significant differences were observed between initial and final values in BMI (P=0.028), LDL (P=0.003), albumin (P<0.001), triglycerides (P=0.027), total cholesterol (P<0.001), ALT (P=0.002), GFR (P=0.010), and the fibrosis scores FIB-4 (P=0.027) and BAAT (P=0.024) (Table 1). No statistically significant differences were found in the comparisons of other parameters (P>0.05).

Regarding the correlations between the initial GFRs (GFR<sub>1</sub>) and the initial liver fibrosis scores

**TABLE 1. Comparison of the Baseline and Sixth-Month Values in the Study Group**

Parameters	Baseline	6th-month	Difference	t, z	P-value
BMI (kg/m <sup>2</sup> )	30.63±5.65	29.85±12.64	0.77±2.94	2.23	<b>0.028</b>
HbA1c (%)	8±2.18	7.9±2	0.94±1.76	0.38	0.704
Platelet (10 <sup>3</sup> /μL)	252 ±86.40	249.73±61.14	252±86/249±61	-1.67	0.095
LDL (mg/dL)	122.94±0.46	112.46±41.61	12.53±32.38	3.095	<b>0.003</b>
HDL (mg/dL)	49.48±14.71	47.69±14.57	1.33±6.15	1.75	0.084
Cholesterol (mg/dL)	212.3±48.32	191.10±51.47	22.98±39.61	4.64	<b>0.001</b>
Triglyceride (mg/dL)	162±122	192.01±157.80	162±122/192±157	-2.21	<b>0.027</b>
Albumin (g/dL)	3.79±0.46	4 ±0.52	3.79±0.46/ 4±0.52	-3.41	<b>&lt;0.001</b>
ALT* (U/L)	19 (9)	18 (13)	19 (9)/ 18(13)	-3.15	<b>0.002</b>
AST* (U/L)	21 (17)	18 (9)	21 (17)/ 18(9)	-1.50	0.133
BUN* (mg/dL)	14 (7)	16 (7)	14 (7)/ 16(7)	-0.91	0.359
Creatinine (mg/dL)*	0.83(0.35)	0.84(0.39)	0.83 (0.35)/ 0.84 (0.39)	-1.51	0.130
GFR (mL/min)	79.98±22.66	76.72±25.15	3.25±10.38	2.66	<b>0.010</b>
BARD	3.23±1.01	3.19±0.86	0.04±1.31	0.26	0.789
BAAT)	2.24±0.71	2.04±0.72	0.22±0.79	2.30	<b>0.024</b>
NFS	-0.30±1.56	-0.14±1.09	-0.09±0.92	-0.85	0.395
FIB-4*	1.04 (0.75)	1.07 (0.61)	1.04 (0.75)/ 1.07 (0.61)	-2.21	<b>0.027</b>
APRI*	0.24 (0.16)	0.21 (0.15)	0.24 (0.16)/ 0.21 (0.15)	-0.75	0.450

Data are shown as mean±standard deviation or median \*(interquartile) where appropriate. BMI, body mass index; HbA1c, hemoglobin 1Ac; LDL, low density lipoprotein; HDL, high density lipoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; GFR, glomerular filtration rate; BARD, BMI+AST/ALT ratio+diabetes; BAAT, BMI+age+ALT+thrombocytes; NFS, NAFLD fibrosis score, FIB-4, fibrosis-4; APRI, AST/platelet ratio index. Statistically significant P-values are shown in bold.

**TABLE 2. Correlation Between Baseline and Sixth-Month GFR and Fibrosis Scores**

	BARD_1		BAAT_1		NFS_1		FIB4_1*		APRI_1*	
	r	P-value	r	P-value	r	P-value	r	P-value	r	P-value
GFR_1	0.145	0.225	-0.062	0.610	-0.569	<b>0.001</b>	-0.405	<b>&lt;0.001</b>	-0.054	0.632
	BARD_2		BAAT_2		NFS_2		FIB4_2*		APRI_2*	
	r	P-value	r	P-value	r	P-value	r	P-value	r	P-value
GFR_2	-0.182	0.125	-0.205	0.097	-0.397	<b>0.001</b>	-0.283	<b>0.016</b>	0.307	<b>0.009</b>
Difference	BARD		BAAT		NFS*		FIB4*		APRI*	
GFR	-0.244	<b>0.039</b>	-0.228	0.063	0.197	0.11	0.107	0.37	0.035	0.769

GFR, glomerular filtration rate; BARD, BMI+AST/ALT ratio+diabetes; BAAT, BMI+age+ALT+thrombocytes; NFS, NAFLD fibrosis score, FIB-4, fibrosis-4; APRI, AST/platelet ratio index.

\*Spearman’s correlation. Statistically significant P-values are shown in bold.

(BARD\_1, BAAT\_1, NFS\_1, FIB-4\_1, and APRI\_1) moderate negative correlations were observed between GFR\_1 and FIB-4\_1 ( $r = -0.405$ ,  $P < 0.001$ ), and between GFR\_1 and NFS\_1 ( $r = -0.569$ ,  $P = 0.001$ ) (Table 2). Despite these significant correlations between GFR\_1 and NFS\_1/FIB-4\_1, regression analyses did not reveal any statistically significant predictive effect of fibrosis scores on GFR\_1 ( $P > 0.05$ ).

As for the correlations between the final GFRs (GFR\_2) and the final fibrosis scores (FIB-4\_2, APRI\_2, BAAT\_2, BARD\_2, and NFS\_2) a weak negative correlation was found between GFR\_2 and FIB-4\_2 ( $r = -0.283$ ,  $P = 0.016$ ), and NFS\_2 ( $r = -0.397$ ,  $P = 0.001$ ), while a weak positive correlation was observed between GFR\_2 and APRI\_2 ( $r = 0.307$ ,  $P = 0.009$ ) (Table 2). Nevertheless, the regression analysis, again, showed no statistically significant effect of fibrosis scores on GFR\_2 ( $P > 0.05$ ).

When the correlations between the change in GFR (difference between the final and initial values) and changes in FIB-4, NFS, APRI, BARD, and BAAT scores were examined, a weak negative correlation was

found only between the GFR difference and the change in BARD score ( $r = -0.244$ ,  $P = 0.039$ ) (Table 2).

Finally, in the analysis of correlations between the change in GFR and the proportional changes in fibrosis scores, a weak negative correlation was observed between the GFR difference and the BARD ratio ( $r = -0.329$ ,  $P = 0.005$ ). In linear regression analysis, where the GFR difference was set as the dependent variable, among the independent variables representing liver fibrosis scores, the BARD ratio was found to be a significant predictor. The model indicated that the BARD ratio accounted for 10.9% of the variance in GFR change. Specifically, a one-unit increase in the BARD ratio was associated with a 4.34-unit decrease in GFR. Additionally, BAAT ratio ( $P = 0.01$ , 95% CI -20.569, -2.895), age ( $P = 0.011$ , 95% CI 6.84, .299), albumin ( $P = 0.04$ , 95% CI .242, 10.625) showed a significant effect on the GFR difference in the linear regression analysis (Table 3). Other laboratory parameters and fibrosis scores did not have a statistically significant effect on the GFR difference.

**TABLE 3. Linear Regression Analysis of Parameters Affecting GFR Difference**

GFR difference	B	Beta	t	P-value	F	R <sup>2</sup>	%95% CI	
							Lower	Upper
BARD ratio	-4.34	-0.329	-2.92	<b>0.005</b>	8.525	0.109	-7.304	-0.1375
Age	-0.249	-0.299	2.617	<b>0.011</b>	6.84	0.089	6.84	.299
Albumin	5.434	0.244	2.088	<b>0.040</b>	4.36	0.059	0.242	0.10.625
BAAT ratio	-11.732	-0.312	-2.651	<b>0.010</b>	0.703	0.098	-20.569	-2.895

GFR, glomerular filtration rate; BARD, BMI+AST/ALT ratio+diabetes; BAAT, BMI+age+ALT+thrombocytes; CI, confidence interval. Statistically significant P-values are shown in bold.

## DISCUSSION

This study aimed to investigate the relationship between changes in renal function and five different non-invasive liver fibrosis scores in patients with diabetic hepatosteatosis. The relationship between NAFLD and CKD is well known. Statistically significant differences between initial and final values were found in BMI, LDL, albumin, triglycerides, total cholesterol, ALT, GFR, and the fibrosis scores FIB-4 and BAAT. Significant correlations were identified between GFR<sub>1</sub> and both FIB-4<sub>1</sub> and NFS<sub>1</sub>, and between GFR<sub>2</sub> and both FIB-4<sub>2</sub> and NFS<sub>2</sub>; and, finally, the regression analysis showed that a one-unit increase in the BARD ratio resulted in a 4.34-unit decrease in GFR difference. It is expected that scores such as FIB-4 and NFS, which include markers of inflammation and cellular stress such as age, platelets, albumin and AST/ALT show a significant relationship with GFR. However, in our study: HbA1c values do not change significantly between the initial and final measurements, the decrease in GFR is especially associated with the change in fibrosis scores, suggesting that it may affect kidney function. All these findings collectively suggested that renal function might be influenced by the severity of the liver fibrosis.

In a retrospective cohort study, Kuma *et al.* [16] examined the possible link between elevated FIB-4 scores and the occurrence of CKD in metabolically healthy men. While a high FIB-4 value ( $\geq 1.30$ ) did not emerge as an independent risk factor for CKD (Odds Ratio [OR]=1.57; 95% Confidence Interval [CI]=0.97–2.56), subgroup analyses revealed notable associations. Specifically, higher FIB-4 scores were significantly related to CKD among participants who were non-obese participants (OR=1.92; CI=1.09–3.40), non-hypertensive (OR=2.15; CI=1.16–3.95), and non-smokers (OR=1.88; CI=1.09–3.23). In these groups, elevated FIB-4 values also showed a strong correlation with reduced estimated GFR, as indicated by multiple linear regression. Based on these observations, the researchers concluded that higher FIB-4 scores could be associated with CKD development over a five-year period in metabolically healthy individuals [16]. In this study, healthy male individuals were evaluated. In our study, the average age of both genders was 60.99 and BMI was 30.63, and it was only conducted in individuals with diabetic

hepatosteatosis. The follow-up period was limited to 6 months. The fact that we couldn't find a significant relationship between FIB4 score and GFR difference in the regression analyses was considered due to our study was conducted in only individuals with diabetic hepatosteatosis. The negative correlations identified in our study between GFR<sub>1</sub> and FIB-4<sub>1</sub>, as well as GFR<sub>2</sub> and FIB-4<sub>2</sub>, appeared consistent with the subgroup outcomes reported by Kuma *et al.*

Hydes *et al.* [17] assessed how NAFLD and liver fibrosis affect adverse clinical outcomes and mortality among patients with CKD. At baseline, 56.2% of the CKD population had NAFLD, 3% had FIB-4  $> 2.67$ , and 7.7% showed NAFLD with NFS  $\geq 0.676$ . In univariate analyses, NAFLD was linked to increased risks of cardiovascular events (Hazard Ratio [HR]=1.49; 95% CI=1.38–1.60), all-cause mortality (HR=1.22; 95% CI=1.14–1.31), and end-stage renal disease (HR=1.26; 95% CI=1.02–1.54). Multivariate analysis confirmed NAFLD as an independent predictor of cardiovascular outcomes (HR=1.20; 95% CI=1.11–1.30;  $P < 0.001$ ). Elevated NFS and FIB-4 levels were also strongly associated with cardiovascular events (HR=2.42; 95% CI=2.09–2.80 and HR=1.64; 95% CI=1.30–2.08, respectively) and overall mortality (HR=2.82; 95% CI=2.48–3.21 and HR=1.82; 95% CI=1.47–2.24, respectively) in univariate analyses. In addition, higher NFS values were related to a significantly greater risk of end-stage renal disease (HR=5.15; 95% CI=3.52–7.52) [17]. These outcomes were in line with the negative correlations we observed between NFS<sub>1</sub> and GFR<sub>1</sub>, and between NFS<sub>2</sub> and GFR<sub>2</sub>. However, unlike Hydes *et al.* [17], our study also included participants with normal GFR values alongside those with CKD.

In another study, Schleicher *et al.* [18] investigated the association between FIB-4 levels and the risk of renal failure in a general population sample. During a 10-year follow-up, renal failure occurred in 9.2% of those with FIB-4  $< 1.3$  and in 10.6% of individuals with FIB-4  $\geq 1.3$  ( $p = 0.007$ ). Having a FIB-4 score  $\geq 1.3$  was linked to a slightly increased risk of renal failure (HR=1.08; 95% CI=1.02–1.14;  $P = 0.009$ ). Moreover, a dose–response pattern was observed, with the highest risk in individuals with FIB-4  $\geq 2.67$  (HR=1.34; 95% CI=1.22–1.46;  $P = 0.001$ ). These findings were consistent with the inverse associations demonstrated in our analysis between GFR<sub>1</sub> and FIB-4<sub>1</sub>, as well

as between GFR<sub>2</sub> and FIB-4<sub>2</sub> [18].

Xiong *et al.* [9] investigated the relationship between CKD and several liver fibrosis indices, including FIB-4, BARD, and BAAT. They demonstrated that patients with CKD had significantly higher scores on all three indices compared to those without CKD. In multivariate logistic regression, each fibrosis marker showed an independent association with CKD (FIB-4: OR=6.71, CI=4.45–10.13; BAAT: OR=1.88, CI=1.29–2.75; BARD: OR=1.72, CI=1.28–2.31) [9]. The negative correlations we detected between GFR<sub>1</sub> and FIB-4<sub>1</sub>, GFR<sub>2</sub> and FIB-4<sub>2</sub>, as well as between GFR change and both BARD score change and BARD ratio in our study, were in agreed with their findings. The significant relationship found in the linear regression analysis between BARD and BAAT ratios and GFR was consistent with the study of Xiong *et al.* [9]. The fact that the BARD ratio predicts GFR change is an important finding, especially since it reflects the effect of fibrosis progression over time on renal function.

In another study, Seko *et al.* [19] sought to determine risk factors for CKD progression in patients with biopsy-confirmed NAFLD. Their multivariate analysis identified male sex (OR=5.46), advanced age, and a FIB-4 score  $\geq 1.30$  as predictors of CKD. Among 154 individuals with baseline GFR  $\geq 60$  mL/min, 30 experienced CKD stage progression, and 15 developed CKD over three years. The authors highlighted the importance of kidney-centred preventive strategies, particularly in patients with both diabetes and NAFLD [19]. Consistent with these results, our observations of negative correlations between GFR<sub>1</sub> and FIB-4<sub>1</sub>, GFR<sub>2</sub> and FIB-4<sub>2</sub>, GFR<sub>1</sub> and NFS<sub>1</sub>, and GFR<sub>2</sub> and NFS<sub>2</sub> suggested that fibrosis indices might serve as early markers of CKD risk in diabetic NAFLD populations.

Wijarnpreecha *et al.* [20] assessed the utility of non-invasive fibrosis markers in diagnosing CKD among 4,142 NAFLD patients, of whom 200 (4.8%) had CKD. ROC analysis revealed AUC (areas under the curve) values of 0.77 for FIB-4, 0.75 for NFS, 0.62 for BARD, and 0.51 for APRI. Compared with low-risk patients, those at high risk of advanced fibrosis had a markedly increased likelihood of CKD, with significant associations for NFS (adjusted OR=4.92, CI=2.96–8.15) and FIB-4 (adjusted OR=2.27, CI=1.05–4.52). Both FIB-4 and NFS independently

predicted CKD in NAFLD patients, with FIB-4 considered the most reliable predictor overall [20]. The inverse association between FIB-4 and GFR in our study group, together with the significant link between GFR difference and BARD ratio, supported these ROC-based findings.

Supriyadi *et al.* [21] conducted a meta-analysis to examine the role of non-invasive fibrosis markers in predicting CKD. Their pooled results demonstrated that elevated FIB-4 scores were associated with higher CKD prevalence (OR=2.51, CI=1.87–3.37,  $P < 0.00001$ ,  $I^2 = 96\%$ ). Additional regression analyses indicated that this relationship was significantly affected by hypertension ( $P = 0.0241$ ), NAFLD ( $p = 0.0029$ ), and BMI ( $p = 0.0025$ ). Similarly, high NFS (OR=2.49, CI=1.89–3.30,  $P < 0.00001$ ,  $I^2 = 96\%$ ) and high APRI (OR=1.40, CI=1.14–1.72,  $P = 0.001$ ,  $I^2 = 26\%$ ) were linked with CKD prevalence. The authors recommended routine use of these markers in both NAFLD patients and the general population to improve risk stratification and facilitate earlier CKD detection [21]. In line with these conclusions, our study also revealed significant associations between GFR and both FIB-4 and NFS. Furthermore, in Mima's investigation [22], which incorporated pre- and post-biopsy analyses, a significant negative correlation between FIB-4 and GFR was reported in nephrosclerosis patients ( $R^2 = 0.4362$ ,  $P = 0.04$ ). Our results were consistent with these findings.

### Strengths and Limitations

The strength of our study was that there was no statistically significant difference in HbA1c levels between baseline and final assessments, implying that HbA1c may not play a role in the effect of fibrosis scores on GFR.

The retrospective nature of the study, conducted at a single centre with a limited number of patients, poses a limitation in terms of the generalizability of its findings. Validation of the results through multicentre studies with larger cohorts would be beneficial.

### CONCLUSION

Given the global rise in CKD and the increasing

prevalence of high-risk conditions such as diabetes, identifying potential risk factors for CKD development and establishing targeted intervention strategies is of critical importance. This study suggested that progression in liver fibrosis, as determined through repeated measurements in time, might contribute to an increased risk of CKD development. This suggests that the BARD score is easier to capture the change in metabolic load as it includes the presence of diabetes, obesity, hepatic enzyme rates. Being a specific analysis for the diabetic hepatosteatosis population differs from other studies based on the general population or the NAFLD population. Two temporal comparisons were made with the same individual. Therefore, the effect of fibrosis progression on kidney function can be expressed more clearly. Furthermore, the absence of a statistically significant difference in HbA1c levels between initial and final assessments implied that HbA1c might not play a role in the impact of fibrosis scores on GFR.

#### *Ethics Approval and Consent to Participate*

This study was approved by the Ufuk University Non-Interventional Clinical Research Evaluation Ethics Committee (Decision No: 24.06.07.02/06; date: 07.06.2024). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Informed consent was not required in this study because this is a retrospective study.

#### *Data Availability*

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

#### *Authors' Contribution*

Study Conception: OC, MFB; Study Design: OC, MFB; Supervision: MFB; Funding: N/A; Materials: N/A; Data Collection and/or Processing: OC; Statistical Analysis and/or Data Interpretation: OC, SKŞ, MFB; Literature Review: OC, SKŞ; Manuscript Preparation: OC; and Critical Review: SKŞ, MFB.

#### *Conflict of Interest*

The author(s) disclosed no conflict of interest during the preparation or publication of this manuscript.

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#### *Generative Artificial Intelligence Statement*

The author(s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author(s) in accordance with scientific research methods and academic ethical principles.

#### *Editor's Note*

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## REFERENCES

- Chalasanani N, Younossi Z, Lavine JE, et al. The diagnosis and management of non-alcoholic fatty liver disease: practice Guideline by the American Association for the Study of Liver Diseases, American College of Gastroenterology, and the American Gastroenterological Association. *Hepatology*. 2012;55(6):2005-2023. doi: 10.1002/hep.25762.
- Younossi Z, Anstee QM, Marietti M, et al. Global burden of NAFLD and NASH: trends, predictions, risk factors and prevention. *Nat Rev Gastroenterol Hepatol*. 2018;15(1):11-20. doi: 10.1038/nrgastro.2017.109.
- Younossi ZM, Golabi P, Paik JM, Henry A, Van Dongen C, Henry L. The global epidemiology of nonalcoholic fatty liver disease (NAFLD) and nonalcoholic steatohepatitis (NASH): a systematic review. *Hepatology*. 2023;77(4):1335-1347. doi: 10.1097/HEP.0000000000000004.
- Estes C, Anstee QM, Arias-Loste MT, et al. Modeling NAFLD disease burden in China, France, Germany, Italy, Japan, Spain,

- United Kingdom, and United States for the period 2016-2030. *J Hepatol.* 2018;69(4):896-904. doi: [10.1016/j.jhep.2018.05.036](https://doi.org/10.1016/j.jhep.2018.05.036).
5. Singh S, Allen AM, Wang Z, Prokop LJ, Murad MH, Loomba R. Fibrosis progression in nonalcoholic fatty liver vs nonalcoholic steatohepatitis: a systematic review and meta-analysis of paired-biopsy studies. *Clin Gastroenterol Hepatol.* 2015;13(4):643-654.e1-9; quiz e39-40. doi: [10.1016/j.cgh.2014.04.014](https://doi.org/10.1016/j.cgh.2014.04.014).
6. GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet.* 2016;388(10053):1459-1544. doi: [10.1016/S0140-6736\(16\)31012-1](https://doi.org/10.1016/S0140-6736(16)31012-1).
7. Ginès P, Graupera I, Lammert F, et al. Screening for liver fibrosis in the general population: a call for action. *Lancet Gastroenterol Hepatol.* 2016;1(3):256-260. doi: [10.1016/S2468-1253\(16\)30081-4](https://doi.org/10.1016/S2468-1253(16)30081-4).
8. Blonde L, Umpierrez GE, Reddy SS, et al. American Association of Clinical Endocrinology Clinical Practice Guideline: Developing a Diabetes Mellitus Comprehensive Care Plan-2022 Update. *Endocr Pract.* 2022;28(10):923-1049. doi: [10.1016/j.eprac.2022.08.002](https://doi.org/10.1016/j.eprac.2022.08.002).
9. Xiong S, Wang P, Yin S, et al. The association between liver fibrosis scores and chronic kidney disease. *Front Med (Lausanne).* 2023;10:1046825. doi: [10.3389/fmed.2023.1046825](https://doi.org/10.3389/fmed.2023.1046825).
10. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. *N Engl J Med.* 2004;351(13):1296-1305. doi: [10.1056/NEJMoa041031](https://doi.org/10.1056/NEJMoa041031).
11. Weiner DE, Tighiouart H, Amin MG, et al. Chronic kidney disease as a risk factor for cardiovascular disease and all-cause mortality: a pooled analysis of community-based studies. *J Am Soc Nephrol.* 2004;15(5):1307-1315. doi: [10.1097/01.asn.0000123691.46138.e2](https://doi.org/10.1097/01.asn.0000123691.46138.e2).
12. Fox CS, Larson MG, Leip EP, Culleton B, Wilson PW, Levy D. Predictors of new-onset kidney disease in a community-based population. *JAMA.* 2004;291(7):844-850. doi: [10.1001/jama.291.7.844](https://doi.org/10.1001/jama.291.7.844).
13. Chen J, Muntner P, Hamm LL, et al. The metabolic syndrome and chronic kidney disease in U.S. adults. *Ann Intern Med.* 2004;140(3):167-174. doi: [10.7326/0003-4819-140-3-200402030-00007](https://doi.org/10.7326/0003-4819-140-3-200402030-00007).
14. Sesti G, Fiorentino TV, Arturi F, Perticone M, Sciacqua A, Perticone F. Association between noninvasive fibrosis markers and chronic kidney disease among adults with nonalcoholic fatty liver disease. *PLoS One.* 2014;9(2):e88569. doi: [10.1371/journal.pone.0088569](https://doi.org/10.1371/journal.pone.0088569).
15. Kotoku K, Michishita R, Matsuda T, et al. The Association between Decreased Kidney Function and FIB-4 Index Value, as Indirect Liver Fibrosis Indicator, in Middle-Aged and Older Subjects. *Int J Environ Res Public Health.* 2021;18(13):6980. doi: [10.3390/ijerph18136980](https://doi.org/10.3390/ijerph18136980).
16. Kuma A, Mafune K, Uchino B, Ochiai Y, Miyamoto T, Kato A. Potential link between high FIB-4 score and chronic kidney disease in metabolically healthy men. *Sci Rep.* 2022;12(1):16638. doi: [10.1038/s41598-022-21039-0](https://doi.org/10.1038/s41598-022-21039-0).
17. Hydes TJ, Kennedy OJ, Buchanan R, et al. The impact of non-alcoholic fatty liver disease and liver fibrosis on adverse clinical outcomes and mortality in patients with chronic kidney disease: a prospective cohort study using the UK Biobank. *BMC Med.* 2023;21(1):185. doi: [10.1186/s12916-023-02891-x](https://doi.org/10.1186/s12916-023-02891-x).
18. Schleicher EM, Gairing SJ, Galle PR, et al. A higher FIB-4 index is associated with an increased incidence of renal failure in the general population. *Hepatol Commun.* 2022;6(12):3505-3514. doi: [10.1002/hep4.2104](https://doi.org/10.1002/hep4.2104).
19. Seko Y, Yano K, Takahashi A, et al. FIB-4 Index and Diabetes Mellitus Are Associated with Chronic Kidney Disease in Japanese Patients with Non-Alcoholic Fatty Liver Disease. *Int J Mol Sci.* 2019;21(1):171. doi: [10.3390/ijms21010171](https://doi.org/10.3390/ijms21010171).
20. Wijarnpreecha K, Thongprayoon C, Scribani M, Ungprasert P, Cheungpasitporn W. Noninvasive fibrosis markers and chronic kidney disease among adults with nonalcoholic fatty liver in USA. *Eur J Gastroenterol Hepatol.* 2018;30(4):404-410. doi: [10.1097/MEG.0000000000001045](https://doi.org/10.1097/MEG.0000000000001045).
21. Supriyadi R, Yanto TA, Hariyanto TI, Suastika K. Utility of non-invasive liver fibrosis markers to predict the incidence of chronic kidney disease (CKD): A systematic review, meta-analysis, and meta-regression. *Diabetes Metab Syndr.* 2023;17(8):102814. doi: [10.1016/j.dsx.2023.102814](https://doi.org/10.1016/j.dsx.2023.102814).
22. Mima A. Prediction of decreased estimated glomerular filtration rate using liver fibrosis markers: a renal biopsy-based study. *Sci Rep.* 2022;12(1):17630. doi: [10.1038/s41598-022-22636-9](https://doi.org/10.1038/s41598-022-22636-9).

# Unmasking Hidden Deficits: Language, Cognitive, and Mathematical Challenges in Children with Allergic Rhinitis

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## Abstract

**Objective:** Children with allergic rhinitis are known to exhibit atypical developmental patterns and may face difficulties in language, speech, cognitive, and academic skills. This study aims to compare children newly diagnosed with allergic rhinitis (ages 6-9) with their typically developing peers in terms of language development, cognitive performance, and mathematical skills.

**Methods:** A total of 70 participants were included in the study, comprising 35 children with newly diagnosed allergic rhinitis and 35 healthy controls. Following the collection of sociodemographic data, participants were assessed using the Test of Language Development Primary-Fourth Edition: Turkish Version (TOLDP-4:T), the Wechsler Intelligence Scale for Children-Revised (WISC-R), and a set of age-appropriate non-routine mathematical problems.

**Results:** According to the TOLDP-4:T results, children in the allergic rhinitis group demonstrated below-average performance in listening, organizing, grammar, and over all language skills, whereas their healthy peers performed at an average level. In the WISC-R assessment, the allergic rhinitis group had significantly lower mean scores compared to the control group. While a significant correlation between verbal IQ scores and mathematical performance was initially found, this relationship was no longer statistically significant after applying the Bonferroni correction.

**Conclusion:** Allergic rhinitis appears to have a negative impact on children's language development, cognitive abilities, and mathematical performance. These findings highlight the importance of early identification and intervention for children with allergic rhinitis to support their developmental outcomes.

**Keywords:** Allergic Rhinitis, Language Impairment, Cognition, Mathematics

Allergic rhinitis is a condition characterized by inflammation of the nasal mucosa following exposure to allergens. This condition significantly reduces the quality of life, impacts productivity, restricts daily activities, and increases the risk of developing related conditions such as sinusitis, middle ear infections, and asthma [1]. The degranulation

of mast cells mediated by immunoglobulin E (IgE) can trigger common symptoms including nasal discharge, itching, sneezing, and nasal congestion. Additionally, less common symptoms may include itching in the palate, ears, and throat, headaches, fatigue, diminished sense of smell, and a sensation of fullness in the ears when exposed to allergens [1, 2].

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In pediatric patients, the common symptoms of allergic rhinitis encompass cough, sneezing, nasal itching, nasal congestion, sore throat, recurrent infections, halitosis, shortness of breath, hypernasal speech, and behavioral issues [3]. Symptoms such as nasal discharge, nasal itching, and sneezing can lead to school absenteeism, hinder participation in sports, and result in social withdrawal. This can create learning difficulties in children struggling to concentrate. Additionally, nasal congestion can negatively affect sleep quality, further reducing overall quality of life. Research indicates that 80% of individuals with hay fever experience fatigue, with 36% potentially facing depressive symptoms [4].

### Allergic Rhinitis and Speech and Language Disorders

Despite the significance of allergic conditions, research exploring their effects on language and speech development in childhood is limited. A recent cross-sectional study involving 639 children with language and speech delays revealed a higher prevalence of allergic symptoms among these children, prompting inquiries into the potential link between allergic conditions and language skills [5]. Given that children with allergic rhinitis may experience allergic inflammation, sleep disturbances, school absenteeism, learning difficulties, and attention deficits, it is plausible that the risk of developing language and speech disorders could be heightened [6].

### Allergic Rhinitis and Cognitive Disorders

Beyond the immediate physical symptoms, allergic rhinitis can give rise to psychosocial and cognitive disorders. Studies have demonstrated that individuals with allergic rhinitis may exhibit impaired learning and comprehension abilities. Specifically, patients experiencing intermittent allergic rhinitis in allergen-laden seasons have shown poorer performance in learning and memory assessments compared to healthy controls [7]. Notably, cognitive functions and decision-making skills have been found to improve significantly during periods devoid of allergen exposure [8].

### The Relationship Between Language and Mathematical Performance

The interconnections among linguistic, symbolic,

and visual representations of mathematical knowledge are multifaceted. These relationships evolve throughout the educational process and continue to develop thereafter [9]. In educational settings, the enhancement of speaking, reading, and writing skills is particularly emphasized within the context of mathematical language. This linguistic foundation plays a crucial role in students' ability to demonstrate knowledge in various contexts, such as standardized tests that frequently contain complex word problems [10]. Moreover, students are often required to articulate their problem-solving strategies in detail.

Albayrak and Erkal [11] noted that one of the primary contributors to failure in mathematics is linked to the level of proficiency achieved in Turkish language classes. Their observations of 535 students indicated that those who excelled in Turkish also tended to perform well in mathematics. The effective development of reading comprehension and expression skills in Turkish positively correlates with success in mathematics, underscoring that proficiency in both subjects mutually supports academic achievement [11].

### The Relationship Between Cognition and Mathematical Performance

Higher-order cognitive skills are vital for the development of mathematical abilities. These skills encompass the capacity to understand the processes involved in problem-solving, including recognizing errors and adapting methods. Individuals with strong higher-order cognitive skills can analyze problems and identify areas needing improvement [12]. Research indicates that higher-order cognitive skills can be cultivated over time [13].

Working memory serves as a central cognitive system that facilitates cognitive processes by maintaining information actively in mind. This capacity undergoes significant developmental changes, increasing in both capacity and processing speed from childhood through adolescence [14]. Research has established a strong correlation between working memory and mathematical success; children with lower working memory capacity generally demonstrate poorer performance in mathematics [15, 16]. Kyttälä and Lehto [15] emphasize that children with lower memory capacity relative to their peers may also exhibit weakened mathematical abilities.

## METHODS

The present study is cross-sectional, utilizing scales and tests administered during face-to-face interviews to assess language, cognitive, and mathematical skills in children aged 6 to 8 years with chronic allergic rhinitis and typical development.

### Participants

Inclusion criteria for the research group included being aged between 6 and 8.11 years, obtaining parental consent for participation, lacking a diagnosis of primary neurological or psychiatric illness, having no mental or motor developmental delays, and have been diagnosed with allergic rhinitis for the first time. Inclusion criterias were identical for the control group, with the exception of the absence of allergic rhinitis diagnosis. A total of 35 children with newly diagnosed with allergic rhinitis and 35 typically developing children matched for age and sex were included in the study.

### Data Collection and Analysis

Data were collected through the face-to-face application of the TOLDP-4:T, WISC-R, and age-appropriate non-routine mathematical problems.

### Data Collection Tools

#### WISC-R (Wechsler Intelligence Scale for Children)

Developed by Wechsler, this intelligence test is specifically designed for children. It serves as a clinical measurement tool for evaluating cognitive abilities in children aged 6 to 16 years. The test comprises two main sections: one assessing verbal abilities and the other performance abilities, with each section containing six subtests. The verbal subtests include “Information, Similarities, Arithmetic, Comprehension, and Digit Span”, while the performance subtests consist of Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Coding. The verbal subtests assess the child's verbal understanding and comprehension, while the performance subtests evaluate cognitive activities requiring perceptual organization [17].

#### TOLDP-4: T (Test of Language Development Primary-Fourth Edition: Turkish Version)

This is the Turkish adaptation of the Test of Language Development, designed for children aged 4 to 8 years and 11 months. Adapted into Turkish by Topbaş and Güven [18], TOLDP-4: T is a norm-referenced standardized test aimed at assessing various aspects of language development. It includes six main subtests: Picture Vocabulary (PV), Relational Vocabulary (RV), Oral Vocabulary (OV), Syntactic Understanding (SU), Sentence Imitation (SI), and Morphological Completion (MC). The raw scores from these core subtests are converted into standard scores for analysis, allowing for the categorization of language development levels. Composite performances such as listening (PV + SU), organizing (RV + SI), speaking (OV + MC), grammar (SU + SI + MC), semantics (PV + RV + OV), and over all language ability (PV + RV + OV + SU + SI + MC) are also calculated [18].

#### Non-Routine Mathematical Problems

It consists of 9 verbal problems developed to examine the non-routine mathematical problem solving performance of primary school children in Turkey. The 9 word problems developed for 6-7 year old children are accompanied by balls, cups, abacus, sticks, balls of various sizes, paper and pencils to model the operations of separation, multiplication, addition, division by grouping, division by sharing, and division by remainder [19]. For 8-9 year old children, 9 verbal problems were presented that included five basic strategies (working backwards, estimation and control, systematic list making, drawing a figure, looking for correlations) among the basic strategies related to problem solving, and appropriate materials were provided for modeling. There is no time limit for the solution for both age groups. There is no need for 4 basic arithmetic operations (addition, subtraction, multiplication, division) skills for solving the problems. The solution can be reached by modeling or other reasoning processes without activating the 4 operations. Reaching the correct solution of the problem is scored as 1; not reaching the correct solution is scored as 0.

#### Data Collection Procedure

All assessments were carried out face-to-face in a quiet environment. In addition to the TOLDP-4:T and

**TABLE 1. Demographic Information of Participants**

Group Variables	Allergic rhinitis			Healthy controls		
	n	Percentage (%)	Mean±SD	n	Percentage (%)	Mean±SD
Gender	Male	21	60	23	65.7	
	Female	14	40	12	34.3	
Age (years)	6-6.11	14	40	11	31.4	6.97±0.79
	7-7.11	12	34.3	14	40	
	8-8.11	9	25.7	10	28.6	
Class	Grade 1	20	57.1	19	54.3	
	Grade 2	9	25.7	10	28.6	
	Grade 3	6	17.1	6	17.1	

SD, standard deviation.

WISC-R applications, age-appropriate non-routine mathematical problems were presented to the children, who were expected to answer after receiving necessary explanations. Appropriate materials (e.g., beans, beads, containers) were provided for the mathematical problems aimed at six-year-old children. The data collection process for each child varied based on their performance, averaging 2-3 hours, with breaks provided at half-hour intervals. All tests were administered in two sessions to ensure completion.

This study was approved by the Istanbul Atlas University Non-Interventional Scientific Research Ethics Committee (Decision no.: 2024-06/16, date:

22.07.2024). Informed consent was obtained from all participants.

### Statistical Analysis

Statistical analyses were conducted using the SPSS Vs 26.0 software package (SPSS Inc., Chicago, IL, USA). The normality of the data was evaluated using the Shapiro-Wilk test, accepting a significance level of  $P > 0.05$ . Descriptive statistics included mean, standard deviation (Mean±SD), minimum and maximum values, frequencies, and percentages. Due to significant deviations from normal distribution, the Mann Whitney U test, a non-parametric technique,

**TABLE 2. Results of Intergroup Comparison of TOLDP-4: T Levels**

TOLDP-4: T	Group	n	Minimum	Maximum	Mean±SD	P-value*
Listening	Healthy controls	35	1.00	6.00	3.69±1.16	<b>0.001</b>
	Allergic rhinitis	35	1.00	4.00	2.86±1.00	
Organizing	Healthy controls	35	1.00	5.00	2.86±1.17	<b>0.019</b>
	Allergic rhinitis	35	1.00	4.00	2.20±1.08	
Speaking	Healthy controls	35	1.00	6.00	3.23±1.21	<b>0.001</b>
	Allergic rhinitis	35	1.00	4.00	2.26±1.12	
Grammar	Healthy controls	35	1.00	5.00	3.11±1.08	<b>0.013</b>
	Allergic rhinitis	35	1.00	4.00	2.51±0.89	
Semantics	Healthy controls	35	2.00	6.00	3.66±0.94	<b>0.001</b>
	Allergic rhinitis	35	1.00	4.00	2.80±1.02	
Overall language ability	Healthy controls	35	1.00	5.00	3.17±1.20	<b>0.005</b>
	Allergic rhinitis	35	1.00	4.00	2.34±1.16	

TOLDP-4: T, test of language development primary-fourth edition: Turkish Version; SD, standard deviation.

\*Mann Whitney U Test. Statistically significant P-values are shown in bold.

was employed for inter-group comparisons. Correlation analyses were conducted using the Spearman correlation test. A  $P < 0.05$  value was considered statistically significant in all analyses.

## RESULTS

A total of 70 participants were included in the study, comprising 35 individuals with allergic rhinitis and 35

healthy control subjects. The variables of the participants, such as gender, age, and the level of education they are enrolled in, are presented in Table 1.

In the allergic rhinitis group, 60% of the participants were male and 40% were female, while 65.7% were male and 34.3% were female in the healthy control group. In terms of age distribution, 40% of the allergic rhinitis group was 6-6.11 years old, 34.3% was 7-7.11 years old and 25.7% was 8-8.11

**TABLE 3. Results of Intergroup Comparison of WISC-R Scores**

WISC-R	Group	n	Minimum	Maximum	Mean±SD	P-value*
Information	Healthy controls	35	5.00	15.00	10.29±2.70	<b>&lt;0.001</b>
	Allergic rhinitis	35	6.00	9.00	7.66±0.80	
Similarities	Healthy controls	35	6.00	18.00	12.17±3.08	<b>&lt;0.001</b>
	Allergic rhinitis	35	6.00	10.00	7.74±1.07	
Arithmetic	Healthy controls	35	6.00	15.00	10.83±2.57	<b>&lt;0.001</b>
	Allergic rhinitis	35	4.00	10.00	7.66±1.33	
Vocabulary	Healthy controls	35	7.00	16.00	9.71±2.01	<b>&lt;0.001</b>
	Allergic rhinitis	35	4.00	8.00	6.46±1.54	
Comprehension	Healthy controls	35	0.00	17.00	8.80±4.57	<b>0.002</b>
	Allergic rhinitis	35	0.00	8.00	5.60±2.14	
Picture completion	Healthy controls	35	4.00	14.00	8.26±2.79	<b>&lt;0.001</b>
	Allergic rhinitis	35	4.00	7.00	5.37±1.14	
Picture arrangement	Healthy controls	35	3.00	18.00	12.20±3.73	<b>&lt;0.001</b>
	Allergic rhinitis	35	4.00	7.00	5.09±0.92	
Block design	Healthy controls	35	8.00	19.00	14.20±3.78	<b>&lt;0.001</b>
	Allergic rhinitis	35	5.00	8.00	6.63±0.94	
Object assembly	Healthy controls	35	8.00	19.00	12.77±2.67	<b>&lt;0.001</b>
	Allergic rhinitis	35	0.00	4.00	3.89±0.68	
Coding	Healthy controls	35	7.00	19.00	13.63±3.38	0.057
	Allergic rhinitis	35	7.00	15.00	11.97±1.40	
Verbal IQ scores	Healthy controls	35	77.00	133.00	101.97±14.18	<b>&lt;0.001</b>
	Allergic rhinitis	35	72.00	89.00	79.26±4.58	
Performance IQ score	Healthy controls	35	94.00	150.00	116.20±14.63	<b>&lt;0.001</b>
	Allergic rhinitis	35	70.00	86.00	75.23±3.96	
Total IQ score	Healthy controls	35	86.00	136.00	109.91±14.60	<b>&lt;0.001</b>
	Allergic rhinitis	35	68.00	80.00	75.40±3.52	

WISC-R, Wechsler intelligence scale for children-revised; SD, standard deviation

\*Mann Whitney U Test. Statistically significant P-values are shown in bold.

years old; in the healthy control group, 31.4% was 6-6.11 years old, 40% was 7-7.11 years old and 28.6% was 8-8.11 years old. The mean age was  $6.86 \pm 0.81$  years in the allergic rhinitis group and  $6.97 \pm 0.79$  years in the healthy control group. In terms of grade distribution, first graders constituted the largest group in both groups (57.1% and 54.3%). Descriptive statistics findings related to the general questions asked to the participants are given in Table 2. Comparison findings of the participants' TOLDP-4:T levels are given in Table 2.

A statistically significant difference was found between the healthy control and allergic rhinitis groups across all skill domains ( $P < 0.05$ ). In the healthy control group, the mean scores for listening ( $3.69 \pm 1.16$ ), organizing ( $2.86 \pm 1.17$ ), speaking ( $3.23 \pm 1.21$ ), grammar ( $3.11 \pm 1.08$ ), semantics ( $3.66 \pm 0.94$ ), and overall language ability ( $3.17 \pm 1.20$ ) were higher compared to the allergic rhinitis group. In the allergic rhinitis group, the corresponding mean scores were  $2.86 \pm 1.00$  for listening,  $2.20 \pm 1.08$  for organizing,  $2.26 \pm 1.12$  for speaking,  $2.51 \pm 0.89$  for grammar,  $2.80 \pm 1.02$  for semantics, and  $2.34 \pm 1.16$  for overall language ability. The intergroup comparison findings of WISC-R test scores are presented in Table 3.

In the healthy control group, scores for information, similarities, arithmetic, vocabulary, comprehension, picture completion, picture organization, block design, object assembly, verbal IQ, performance IQ, and overall IQ were significantly higher than in the allergic rhinitis group ( $P < 0.05$ ). No significant difference was found in the coding score ( $P = 0.057$ ). Comparison of math scores is presented in Table 4.

The mean score was  $2.63 \pm 1.31$  in the healthy control group and  $1.06 \pm 0.94$  in the allergic rhinitis group and the difference between the groups was statistically significant ( $P = 0.000$ ). The relationship between WISC-R scores and math performance was examined by Spearman correlation analysis. The

findings are presented in Table 5.

In the correlation tests conducted between mathematics performance and WISC-R subtests, while there was a moderate positive significant relationship between only verbal IQ scores and mathematics performance before correction ( $r = 0.405$ ,  $P = 0.016$ ), no statistically significant relationship was found between any variable and mathematics performance after Bonferroni correction. According to the correlation analysis, no significant relationship was found between mathematics performance and TOLDP-4:T levels with any variable.

## DISCUSSION

This study investigates the language, cognitive, and mathematical performance of children aged 6 to 8.11 years diagnosed with chronic allergic rhinitis. A total of 70 participants, comprising 35 children with newly diagnosed allergic rhinitis and 35 typically developing peers, were assessed using the Test of Language Development Primary-Fourth Edition: Turkish Version (TOLDP-4:T), the Wechsler Intelligence Scale for Children-Revised (WISC-R), and Non-Routine Mathematical Problems.

Chronic allergic rhinitis is a prevalent health condition that can significantly impair the quality of life of affected individuals [20]. The symptoms associated with this condition, including nasal congestion, sneezing, and itching, often hinder the ability to concentrate, which may detrimentally affect academic performance [21]. Difficulties in reading and writing can ensue, contributing to attention deficits and subsequent learning challenges. Research has documented that children with allergic rhinitis may struggle to engage fully in classroom activities, or may exhibit diminished concentration during participation [22]. Such challenges can adversely impact academic success and limit future educational and career opportunities.

**TABLE 4. Results of Intergroup Comparison of Mathematics Scores**

Group	n	Minimum	Maximum	Mean±SD	P-value*
Healthy controls	35	0.00	5.00	2.63 1.31	<b>&lt;0.001</b>
Allergic rhinitis	35	0.00	3.00	1.06 0.94	

SD, standard deviation.

\*Mann Whitney U Test. Statistically significant P-value is shown in bold.

**TABLE 5. The Relationship Between WISC-R & TOLDP-4: T and Mathematics Performance**

WISC-R		Math performance	TOLDP-4: T		Math Performance
<b>Information</b>	r	0.154	<b>Listening</b>	r	-0.223
	<b>P-value</b>	0.377		<b>P-value</b>	0.197
<b>Similarities</b>	r	0.119	<b>Organizing</b>	r	0.104
	<b>P-value</b>	0.497		<b>P-value</b>	0.551
<b>Arithmetic</b>	r	0.105	<b>Speaking</b>	r	0.234
	<b>P-value</b>	0.547		<b>P-value</b>	0.176
<b>Vocabulary</b>	r	0.232	<b>Grammar</b>	r	0.066
	<b>P-value</b>	0.181		<b>P-value</b>	0.705
<b>Comprehension</b>	r	0.168	<b>Semantic</b>	r	0.115
	<b>P-value</b>	0.336		<b>P-value</b>	0.509
<b>Picture completion</b>	r	0.242	<b>Overall language ability</b>	r	0.127
	<b>P-value</b>	0.162		<b>P-value</b>	0.468
<b>Picture arrangement</b>	r	0.127			
	<b>P-value</b>	0.467			
<b>Block design</b>	r	0.157			
	<b>P-value</b>	0.367			
<b>Object assembly</b>	r	-0.009			
	<b>P-value</b>	0.959			
<b>Coding</b>	r	-0.075			
	<b>P-value</b>	0.667			
<b>Verbal IQ scores</b>	r	0.405*			
	<b>P-value</b>	0.016			
<b>Performance IQ score</b>	r	0.235			
	<b>P-value</b>	0.175			
<b>Total IQ score</b>	r	0.321			
	<b>P-value</b>	0.060			

TOLDP-4: T, test of language development primary-fourth edition; Turkish Version; WISC-R, wechsler intelligence scale for children-revised; SD, standard deviation; r, correlation coefficient; Math, mathematics

P<0.05/13≈0.0038, Spearman correlation analysis

Comparison of TOLDP-4:T scores revealed statistically significant differences across all skill levels between the groups. Specifically, the allergic rhinitis group exhibited lower composite scores in listening, organizing, grammar, speaking, and comprehension, indicating potential delays in language development. The physical symptoms of allergic rhinitis, particularly nasal congestion, can distract individuals from verbal communication and comprehension, leading to compromised listening

abilities [23]. Furthermore, persistent nasal congestion may interfere with sound transmission, thereby impairing verbal communication [24]. These deficits in language and communication skills can also limit social interactions, as difficulties in expressing oneself may lead to social isolation [25]. The critical role of language in educational contexts underscores the importance of addressing these challenges to promote academic success.

Analysis of WISC-R scores similarly indicated

significant disparities between the groups, with the allergic rhinitis participants scoring lower in multiple subtests, including general intelligence, similarities, arithmetic, vocabulary, comprehension, and performance IQ scores. The similarities subtest evaluates verbal abstract thinking and the ability to analyze relationships, which are essential for cognitive processing [17, 26]. The arithmetic subtest, which assesses mathematical skills and cognitive processes such as attention and memory, further illustrates the cognitive implications of allergic rhinitis [17, 26]. The block design subtest evaluates visual-spatial abilities and perceptual motor skills, which may also be compromised by the inflammatory effects of allergic rhinitis on brain function [7]. Various studies have linked allergic rhinitis in children to attention deficits and learning difficulties, further corroborating the notion that this condition adversely affects cognitive functioning. The observed patterns suggest that the cognitive impairments associated with allergic rhinitis may be exacerbated by sleep disturbances and daytime fatigue [27]. Effective management of allergic rhinitis could potentially enhance cognitive functions and academic outcomes, highlighting the need for integrated treatment approaches that include cognitive development support [28]. The inflammatory processes associated with allergic rhinitis may underlie the cognitive difficulties observed in this population [28].

In terms of performance on non-routine mathematical problems, the healthy control group outperformed the allergic rhinitis group, suggesting that allergic rhinitis may impair cognitive functions and attention necessary for problem-solving. Existing literature supports the detrimental effects of allergic rhinitis on cognitive performance, particularly in relation to attention and memory [28].

The correlation analysis between WISC-R scores and mathematical performance yielded a significant relationship between verbal IQ scores and mathematical performance prior to correction for multiple comparisons. However, following Bonferroni correction, no statistically significant relationships were found between mathematical performance and any of the tested variables. This finding aligns with research suggesting that children's mathematical performance is influenced by a combination of

cognitive abilities and social-emotional factors [29]. Health challenges, such as allergies, may elevate stress levels in children, further negatively impacting academic success.

### Strengths and Limitations

This study provides valuable insights into the language, cognitive, and mathematical challenges faced by children with allergic rhinitis; however, several limitations must be acknowledged. First, the relatively small sample size (n=70) may limit the generalizability of the findings to the broader pediatric population. Larger-scale studies would enhance statistical power and allow for subgroup analyses based on variables such as symptom severity or allergy duration. Second, detailed clinical data such as duration of allergic symptoms, comorbid conditions, medication use, and history of medical treatment were not collected, which may have influenced the observed cognitive and academic outcomes. Additionally, the study did not include follow-up assessments to examine whether the observed deficits persist over time or respond to medical and/or educational interventions. Lastly, environmental and psychosocial factors that may affect developmental outcomes - such as socioeconomic status, parental education, and sleep quality - were not controlled for, which could have acted as confounding variables. Future research addressing these factors is necessary to better understand the long-term developmental impacts of allergic rhinitis in childhood.

One of the major strengths of this study is that it provides a clinically meaningful and balanced framework by comparing children newly diagnosed with allergic rhinitis with age- and sex-matched healthy peers. In addition, the study examined language development, cognitive functioning, and mathematical performance within the same sample, thereby offering a multidimensional perspective on the potential impact of allergic rhinitis on child development. The use of standardized and widely accepted assessment tools enhances the scientific reliability of the findings, while the concurrent differences identified across language, cognition, and academic performance further strengthen the clinical

significance of the study. In this respect, the study makes an original and valuable contribution to the field by demonstrating that allergic rhinitis may have consequences extending beyond physical symptoms to developmental and academic domains, thereby underscoring the importance of early recognition, multidisciplinary assessment, and appropriate supportive intervention planning.

## CONCLUSION

This study highlights the poorer performance of children with allergic rhinitis in language development, as indicated by TOLDP-4:T scores, and cognitive functioning as assessed by WISC-R. The significant differences in general intelligence and cognitive abilities between the two groups underscore the adverse impact of allergic rhinitis on cognitive functions. To address these challenges, it is crucial to conduct thorough evaluations of potential difficulties in language, cognitive, and academic domains alongside medical treatment for allergic rhinitis. The integration of behavioral and psychosocial interventions may further support the development of affected children.

### *Ethics Approval and Consent to Participate*

This study was approved by the Istanbul Atlas University Non-Interventional Scientific Research Ethics Committee (Decision no.: 2024-06/16, date: 22.07.2024). Informed consent was obtained from all participants.

### *Authors' Contribution*

Study Conception: MS, GİE; Study Design: MS, SKB; Supervision: MS, FD; Funding: N/A; Materials: GİE, FD; Data Collection and/or Processing: GİE, FD; Statistical Analysis and/or Data Interpretation: SKB, MS; Literature Review: MS, GİE; Manuscript Preparation: MS, SKB; and Critical Review: MS, FD.

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The author(s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author(s) in accordance with scientific research methods and academic ethical principles.

### *Editor's note*

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## REFERENCES

1. Skoner DP. Allergic rhinitis: definition, epidemiology, pathophysiology, detection, and diagnosis. *J Allergy Clin Immunol.* 2001;108(1 Suppl):S2-8. doi: 10.1067/mai.2001.115569.
2. Turner PJ, Kemp AS. Allergic rhinitis in children. *J Paediatr Child Health.* 2012;48(4):302-310. doi: 10.1111/j.1440-1754.2010.01779.x.
3. Ayanoglu M, Can D, Nacaroglu HT, et al. Prevalence of allergic rhinitis and risk factors in school children. *Trends Pediatr.* 2021;2(2):67-77. doi: 10.5222/TP.2021.21939.
4. Duman H, Dibek Misirlioglu E, Giniş T, Bostancı İ. [Allergic Rhinitis in Children]. *J Child.* 2010;9(2):62-68. doi: 10.5222/j.child.2010.062. [Article in Turkish]
5. Kandelaki E, Kavlashvili N, Kherkheulidze M, Chkhaidze I. Prevalence of Atopic Dermatitis Symptoms in Children With Developmental and Behavioral Problems. *Georgian Med News.* 2015;(243):29-33.
6. Strom MA, Silverberg JI. Asthma, hay fever, and food allergy are associated with caregiver-reported speech disorders in US children. *Pediatr Allergy Immunol.* 2016;27(6):604-611. doi: 10.1111/pai.12580.
7. Marshall PS, O'Hara C, Steinberg P. Effects of seasonal allergic rhinitis on selected cognitive abilities. *Ann Allergy Asthma Immunol.* 2000;84(4):403-410. doi: 10.1016/S1081-1206(10)62273-9.
8. Comoğlu Ş, Keleş N. [Allergic Rhinitis and Comorbid Diseases]. *Turk Klin J ENT Spec Top.* 2015;8(1):54-99. [Article in Turkish]
9. Uptegrove EB. Shared communication in building mathematical ideas: A longitudinal study. *J Math Behav.* 2015;40 (Part A):106-130. doi: 10.1016/j.jmathb.2015.02.001.
10. Cheuk T. The language of mathematics and summative assessment. In: Bailey AL, Maher CA, Wilkinson LC, editors. *Language, Literacy, and Learning in the STEM Disciplines: How Language Counts for English Learners.* New York: Routledge; 2018. p. 185-202.
11. Albayrak M, Erkal M. [The combination of expression and

- skill lessons (Turkish-Mathematics) on the road to success]. *Milli Eğitim Dergisi*. 2003;30(158):150-155. [Article in Turkish].
12. Schoenfeld AH. Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics. In: Grouws DA, editor. *Handbook of Research on Mathematics Teaching and Learning*. New York: Macmillan; 1992. p. 334-370.
13. Lester FK Jr. Reflections about mathematical problem-solving research. In: Charles RI, Silver EA, editors. *The teaching and assessing of mathematical problem solving*. NCTM; 1989. p. 115-124.
14. Spencer JP. The development of working memory. *Curr Dir Psychol Sci*. 2020;29(6):545-553. doi: 10.1177/0963721420959835.
15. Kytälä M, Lehto JE. Some factors underlying mathematical performance: the role of visuospatial working memory and non-verbal intelligence. *Eur J Psychol Educ*. 2008;23(1):77-94. doi: 10.1007/BF03173141.
16. Geary DC, Bailey DH, Hoard MK. Predicting Mathematical Achievement and Mathematical Learning Disability With a Simple Screening Tool: The Number Sets Test. *J Psychoeduc Assess*. 2009;27(3):265-279. doi: 10.1177/0734282908330592.
17. Savaşır ŞN. Wechsler Intelligence Scale for Children (WISC-R) manual. Ankara: Turkish Psychol Assoc; 1995.
18. Topbaş S, Güven S. Turkish school-age language development test (TODIL) user guide. Ankara: Detay Publishing; 2017.
19. Altun M, Arslan Ç. [A Study on Primary School Students' Learning of Problem-Solving Strategies]. *Uludağ Üniv Eğitim Fak Derg*. 2006;19(1):1-21. [Article in Turkish]
20. Bousquet J, Khaltaev N, Cruz AA, et. al; World Health Organization; GA(2)LEN; AllerGen. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen). *Allergy*. 2008;63 Suppl 86:8-160. doi: 10.1111/j.1398-9995.2007.01620.x.
21. Miraglia Del Giudice M, Marseglia A, Leonardi S, et al. Allergic rhinitis and quality of life in children. *Int J Immunopathol Pharmacol*. 2011;24(4 Suppl):25-28. doi: 10.1177/03946320110240s406.
22. Blaiss MS, Hammerby E, Robinson S, Kennedy-Martin T, Buchs S. The burden of allergic rhinitis and allergic rhinoconjunctivitis on adolescents: a literature review. *Ann Allergy Asthma Immunol*. 2018;121(1):43-52. doi: 10.1016/j.anai.2018.04.019.
23. Bousquet J, Schünemann HJ, Samolinski B, et al.; World Health Organization Collaborating Center for Asthma and Rhinitis. Allergic Rhinitis and its Impact on Asthma (ARIA): achievements in 10 years and future needs. *J Allergy Clin Immunol*. 2012;130(5):1049-1062. doi: 10.1016/j.jaci.2012.07.053.
24. Scadding GK. Optimal management of allergic rhinitis. *Arch Dis Child*. 2015;100(6):576-82. doi: 10.1136/archdischild-2014-306300.
25. Canonica GW, Mullol J, Pradaliere A, Didier A. Patient perceptions of allergic rhinitis and quality of life: findings from a survey conducted in Europe and the United States. *World Allergy Organ J*. 2008;1(9):138-144. doi: 10.1097/WOX.0b013e3181865faf.
26. Kaufman AS. *Intelligent testing with WISC-R*. Oxford: Wiley Intersci Publ; 1979.
27. D'Elia C, Gozal D, Bruni O, Goudouris E, Meira E Cruz M. Allergic rhinitis and sleep disorders in children - coexistence and reciprocal interactions. *J Pediatr (Rio J)*. 2022;98(5):444-454. doi: 10.1016/j.jpmed.2021.11.010.
28. Nagata A, Onishi K, Masumoto T, Nakagawa T, Ishitsuka K, Kurozawa Y. Early childhood neurodevelopmental milestones in children with allergic diseases: the Japan Environment and Children's Study (JECS). *Sci Rep*. 2024;14(1):6460. doi: 10.1038/s41598-024-57210-y.
29. Thongseiratch T, Chandeying N. Chronic Illnesses and Student Academic Performance. *J Health Sci Med Res*. 2020;38(3):245-253. doi: 10.31584/jhsmr.2020738.

# Helicobacter Pylori Seropositivity in Patients with Ankylosing Spondylitis: What Does It Imply?

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## Abstract:

**Objective:** This study investigates clinical factors associated with *Helicobacter pylori* (*H. pylori*) seropositivity in patients with ankylosing spondylitis (AS), a condition in which *H. PYLORI* has been underexplored.

**Methods:** AS patients meeting the modified New York criteria, aged 18-65 years, without comorbidities and followed between 2022 and 2023, were included. Serum anti-*H. pylori* IgG and IgA antibodies were measured using ELISA and categorized as negative, positive, or highly positive based on titer levels.

**Results:** The cohort consisted of 243 patients, 36.8% males and 63.2% females, with a mean age of 46.6 years and a mean disease duration of 7.9 years. Logistic regression analysis revealed that increasing age significantly elevated the risk of both IgG and IgA seropositivity. Elevated erythrocyte sedimentation rate was strongly associated with IgA positivity (Odds Ratio [OR]: 3.08, 95% Confidence Interval [CI]: 2.05-4.11), while hypomagnesemia (mean serum Mg: 1.95±0.09) also increased the likelihood of IgA seropositivity (OR: 2.82, 95% CI: 1.05-2.88). Notably, hip involvement emerged as a robust predictor of IgG seropositivity (OR: 3.48, 95% CI: 1.52-6.04), and a history of uveitis was linked to a 1.61-fold increased risk of IgG positivity.

**Conclusion:** The findings suggest that older AS patients with systemic inflammation or low magnesium levels are more likely to exhibit *H. pylori* infection. Moreover, hip involvement and uveitis may serve as relevant clinical markers warranting *H. pylori* screening in this population. These associations highlight potential pathogenetic links between microbial triggers and disease expression in AS.

**Keywords:** Helicobacter Pylori, Spondylitis Ankylosing, Inflammation, Uveitis, Hip Joint

*Helicobacter pylori* (*H. pylori*) is a gram negative bacteria that infects the gastric mucosa and commonly causes of gastritis, duodenal and/or gastric ulcers. Contaminated food and water, close contact with infected individuals, gastroesophageal reflux, intrafamilial transmission and smoking are risk factors for the infection [1]. A growing body of evidence, including a recently published systematic review and meta-analysis, has

confirmed the strong link between *H. pylori* infection and the development of gastric cancer [2]. It has been emphasized that while the global prevalence of *H. pylori* infection has declined among adults over the past three decades, it has remained relatively unchanged in children and adolescents [3]. These findings may serve as a guide for emphasizing the importance of continuing *H. pylori* screening in younger populations, considering the spectrum of

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diseases associated with the infection.

*H. pylori* is increasingly studied as a trigger of autoimmunity, potentially contributing to diseases like lupus, rheumatoid arthritis, and Sjögren's syndrome via chronic inflammation, increased autoantibody production, and impaired immune tolerance [4]. Beyond autoimmune diseases, *H. pylori* infection has also been implicated in the pathogenesis of various other immune-mediated disorders, including inflammatory bowel disease and psoriasis. *H. pylori* and various other immune-mediated disorders may share common pathogenic mechanisms, including chronic inflammation, molecular mimicry, and alterations in mucosal immunity [5]. Among the most widely implicated mechanisms are molecular mimicry and alterations in mucosal immunity, both of which may contribute to the development of immune-mediated disorders in the context of *H. pylori* infection [6].

Ankylosing spondylitis (AS) is a chronic inflammatory rheumatic disease, mainly affecting young men. It is strongly linked to Human Leukocyte Antigen Class I Molecule B27 (HLA-B27) and influenced by gut dysbiosis, infections, and modifiable factors like smoking [7]. Various infectious agents particularly gastrointestinal and urogenital pathogens may significantly increase the risk of AS, supporting the hypothesis that infections could act as culprit triggers in genetically predisposed individuals [8]. A microbial diversity and composition, including a reduction in beneficial commensals and an increase in pro-inflammatory taxa may cause gut microbial imbalance and may contribute to the immunopathogenesis of AS [9].

A Danish cohort found higher AS prevalence in *H. pylori*-positive individuals. However, after 8 years, new AS cases were fewer among those previously *H. pylori*-positive, suggesting *H. pylori* eradication may have a protective role in AS pathogenesis [10]. Although *H. pylori* infection may promote systemic inflammation, prior studies show no consistent association with increased disease activity scores in affected patients [11]. Recent evidence links higher *H. pylori* seropositivity to poor Tumor necrosis factor (TNF) inhibitor response in AS, suggesting that chronic *H. pylori* infection may contribute to resistance to biologic therapies [12].

So, in light of current scientific data, the link

between *H. pylori* infection and axial spondyloarthritis (axSpA) is not definitively established. Is *H. pylori* infection a causative factor or merely an associated condition in individuals with spondyloarthritis (SpA)? The strength of the association also remains poorly defined. We aimed to identify disease-related determinants of *H. pylori* positivity among patients diagnosed with AS.

## METHODS

### Patient Selection

This is a retrospective cohort study conducted on patients who presented to the rheumatology outpatient clinic at Pamukkale University. Patients diagnosed with AS based on the modified New York classification criteria were enrolled in this study. Inclusion criteria comprised an age range of 18 to 65 years, consistent outpatient follow-up between 2022 and 2023, and the absence of comorbid conditions. Patients for whom *H. pylori* data were accessible were enrolled in the study. The medical records of these patients were retrospectively reviewed. From the patients' medical records, detailed information was extracted, including age, sex, demographic characteristics, treatment regimens, disease phenotypes, and the presence or absence of AS in first-degree relatives as reported family history.

### Assessments

Conventional radiographs were available for all patients in the institutional system, whereas Magnetic resonance imaging (MRI) data were not consistently present. To ensure a homogeneous study population, only patients who met the modified New York criteria for AS based on radiographic findings were included. Patients classified as having non-radiographic axSpA were excluded from the study. All AS patients were classified in according to the modified New York classification criteria [13]. HLA-B27 was tested with flow cytometry according to the methods described by Albrecht and Muller [14]. Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) was used to evaluate disease activity [15]. To assess disease activity, patients were stratified into four groups according to their BASDAI scores. A BASDAI score

of <2 was considered indicative of disease remission; scores between 2 and <4 were classified as low disease activity. Patients with scores between 4 and <6 were categorized as having moderate disease activity, while scores  $\geq 6$  were considered representative of high disease activity.

The presence of uveitis, psoriasis, hip joint involvement and inflammatory bowel disease was recorded based on documentation in the patients' medical records indicating that these conditions had been diagnosed, managed, or followed by relevant specialists (ophthalmology, dermatology, orthopedics, and gastroenterology, respectively). A history of any of these manifestations - regardless of whether they were active at the time of evaluation, their frequency, or whether they occurred only once - was considered positive.

Serum immunoglobulin G and immunoglobulin A antibodies to *H. pylori* were measured by enzyme-linked immunosorbent assay (ELISA) [16]. Patients were classified according to *H. pylori* antibody titers

(positive for  $\geq 10$  U/mL, high positive for  $\geq 100$  U/mL and negative for < 9.9 U/mL) [17].

Ethical approval for this non-interventional study was obtained from the Pamukkale University non-interventional clinical research ethics committee (approval number: 20, protocol code: 11/2019), granted on 19 November 2019.

### Statistical Analysis

In the analysis of data, descriptive statistics, including mean, standard deviation, frequency, and percentage values, have been presented. To examine the measurements by groups, an Independent Samples t-test analysis was conducted. For the analysis of proportional variables, a Chi-square test was performed, with Fisher's correction applied when necessary. Logistic regression analysis was used to examine the impact of multiple risk factors on the positivity of anti-*H. pylori* Ig A and *H. pylori* Ig G. The logistic regression analysis was calculated adjusted for smoking, disease duration and sex factors. Odds ratio and 95% confidence interval were calculated for the risk factors. In this study, P-value<0.05 was considered statistically significant. Analyses were performed using SPSS 25.00.

## RESULTS

A total of 243 AS patients were included, of the patients, 36.8 % were male, and 63.2 % were female. The average age of the patients was  $46.59 \pm 11.97$  years, and the average disease duration was  $7.89 \pm 9.28$  years (Table 1). A Chi-square test indicated no significant effect of smoking, gender, HLA-B27 positivity, or other factors on *H. pylori* Ig A and *H. pylori* Ig G Positivity, except for uveitis and hip involvement, which showed significant associations with the presence of *H. pylori* Ig G positivity, shown in Table 2. No statistically significant association was observed between either *H. pylori* Ig A or *H. pylori* Ig G positivity and the type or frequency of analgesic or biologic agent use (Table 3). Among analgesics, diclofenac was the most commonly used drug across all subgroups. Meloxicam showed a slightly higher usage in *H. pylori* Ig A positive (8.4%) compared to *H. pylori* Ig A negative (3.1%) patients, although this difference did not reach statistical significance (P=0.23). Regarding biologic therapies, no significant

**TABLE 1. General Patient Characteristics and *H. Pylori* Ig A/ *H. Pylori* Ig G Positivity in the whole Study Group**

Variables	Data
<b>Gender</b>	
Male	82 (36.8%)
Female	141 (63.2%)
<b>Age (years)</b>	46.59 $\pm$ 11.97
<b>Disease duration (years)</b>	7.89 $\pm$ 9.28
<b>Smoking</b>	
None	144 (64.6%)
Yes	79 (35.4%)
<b><i>H. pylori</i> Ig A positivity</b>	
Negative	128 (57.4%)
Positive	75 (33.6%)
High positive	20 (9.0%)
<b><i>H. pylori</i> Ig G positivity</b>	
Negative	96 (43.0%)
Positive	101 (45.3%)
High positive	26 (11.7%)

Data are shown as mean $\pm$ standard deviation or n (%).

*H. pylori*, *helicobacter pylori*.

**TABLE 2.** Factors that related to *H. Pylori* Ig A/ *H. Pylori* Ig G Positivity

		<i>H. pylori</i> Ig A positivity			<i>H. pylori</i> Ig G positivity		
		Negative	Positive	P-value	Negative	Positive	P-value
<b>Smoking, n (%)</b>	No	77 (60.2)	67 (70.5)	0.07	59 (61.5)	85 (66.9)	0.24
	Yes	51 (39.8)	28 (29.5)		37 (38.5)	42 (33.1)	
<b>Gender, n (%)</b>	Male	47 (36.7)	35 (36.8)	0.58	36 (37.5)	46 (36.2)	0.48
	Female	81 (63.3)	60 (63.2)		60 (62.5)	81 (63.8)	
<b>HLA B27 positivity, n (%)</b>	No	57 (44.5)	43 (45.7)	0.48	40 (41.7)	60 (47.6)	0.23
	Yes	71 (55.5)	51 (54.3)		56 (58.3)	66 (52.4)	
<b>Acute sacroiliitis at the diagnosis, n (%)</b>	No	35 (27.3)	33 (34.7)	0.15	28 (29.2)	40 (31.5)	0.41
	Yes	93 (72.7)	62 (65.3)		68 (70.8)	87 (68.5)	
<b>Family history, n (%)</b>	No	72 (56.3)	60 (63.2)	0.18	56 (58.3)	76 (59.8)	0.46
	Yes	56 (43.8)	35 (36.8)		40 (41.7)	51 (40.2)	
<b>Inflammatory bowel disease, n (%)</b>	No	122 (95.3)	91 (95.8)	0.58	91 (94.8)	122 (96.1)	0.44
	Yes	6 (4.7)	4 (4.2)		5 (5.2)	5 (3.9)	
<b>Uveitis, n (%)</b>	No	111 (86.7)	84 (88.4)	0.43	87 (90.6)	108 (85)	<b>0.04*</b>
	Yes	17 (13.3)	11 (11.6)		9 (9.4)	19 (15)	
<b>Psoriasis, n (%)</b>	No	124 (96.9)	94 (98.9)	0.29	94 (97.9)	124 (97.6)	0.63
	Yes	4 (3.1)	1 (1.1)		2 (2.1)	3 (2.4)	
<b>Enthesitis, n (%)</b>	No	73 (57)	59 (62.1)	0.27	57 (59.4)	75 (59.1)	0.54
	Yes	55 (43)	36 (37.9)		39 (40.6)	52 (40.9)	
<b>Dactylitis, n (%)</b>	No	125 (97.7)	94 (98.9)	0.43	93 (96.9)	126 (99.2)	0.21
	Yes	3 (2.3)	1 (1.1)		3 (3.1)	1 (0.8)	
<b>Arthritis, n (%)</b>	No	94 (73.4)	70 (73.7)	0.55	74 (77.1)	90 (70.9)	0.19
	Yes	34 (26.6)	25 (26.3)		22 (22.9)	37 (29.1)	
<b>Hip involvement, n (%)</b>	No	124 (96.9)	87 (91.6)	0.08	95 (99)	116 (91.3)	<b>0.02*</b>
	Yes	4 (3.1)	8 (8.4)		1 (1)	11 (8.7)	
<b>Dyspepsia, n (%)</b>	No	95 (74.2)	72 (75.8)	0.43	75 (78.1)	92 (72.4)	0.49
	Yes	33 (25.8)	23 (24.2)		21 (21.9)	35 (27.6)	
<b>BASDAI, n (%)</b>	Remission	47 (36.7)	46 (48.4)	0.62	36 (37.5)	57 (44.9)	0.64
	Low	14 (10.9)	10 (10.5)		11 (11.5)	13 (10.2)	
	Moderate	24 (18.8)	12 (12.6)		15 (15.6)	21 (16.5)	
	High	43 (33.6)	27 (28.4)		34 (35.4)	36 (28.3)	

BASDAI, bath ankylosing spondylitis disease activity index; HLA B27, human leukocyte antigen B27; *H. pylori*, *Helicobacter pylori*. \*Chi-square test. Statistically significant P-values are shown in bold.

**TABLE 3. Distribution of analgesic and Biologic Therapy Usage According to *H. pylori* Ig A and *H. pylori* Ig G antibody seropositivity**

		<i>H. pylori</i> Ig A		P-value	<i>H. pylori</i> Ig G		P-value
		Negative	Positive		Negative	Positive	
<b>Analgesics, n (%)</b>	None	6 (4.7)	6 (6.3)	0.23	6 (6.3)	6 (4.7)	0.29
	Diclofenac	55 (43)	37 (38.9)		46 (47.9)	46 (36.2)	
	Indomethacin	20 (15.6)	13 (13.7)		13 (13.5)	20 (15.7)	
	Asemetazin	18 (14.1)	13 (13.7)		13 (13.5)	18 (14.2)	
	Ibuprofen	10 (7.8)	9 (9.5)		9 (9.4)	10 (7.9)	
	Meloxicam	4 (3.1)	8 (8.4)		3 (3.1)	9 (7.1)	
	Other	15 (11.7)	9 (9.5)		6 (6.3)	18 (14.2)	
	<b>Biologic Therapies, n (%)</b>	None	83 (64.8)		59 (62.1)	0.72	
Golimumab	7 (5.5)	2 (2.1)	5 (5.2)	4 (3.1)			
Etanercept	10 (7.8)	8 (8.4)	12 (12.5)	6 (4.7)			
Adalimumab	13 (10.2)	13 (13.7)	8 (8.3)	18 (14.2)			
Certolizumab	8 (6.3)	7 (7.4)	7 (7.3)	8 (6.3)			
Secukinumab	3 (2.3)	5 (5.3)	4 (4.2)	4 (3.1)			
Infliximab	4 (3.1)	1 (1.1)	3 (3.1)	2 (1.6)			

*H. pylori*, *helicobacter pylori*.

differences were noted between groups.

A significant difference was found in age and erythrocyte sedimentation rate (ESR) levels in relation to *H. pylori* Ig A positivity. The magnesium levels were lower and ESR was higher in *H. pylori* Ig A positive patients compared to *H. pylori* Ig A negative patients. *H. pylori* Ig G positivity was also significantly associated with increased age and the hip involvement. The numerical data are presented in detail in Table 4.

The variables examined up to this point are those analyzed univariately. In Table 5, the risks and effects of the variables affecting *H. pylori* Ig A positivity are examined to determine whether they are the same. Logistic regression analysis indicated that ESR, age, and magnesium levels were significant risk factors for *H. pylori* Ig A positivity. Both of high ESR and elderly-age increased the likelihood of *H. pylori* Ig A positivity, and lower magnesium levels also increased the risk. The ability of the variables ESR, age, and magnesium levels to explain the risk of *H. pylori* Ig A positivity was found to be 29% (Neg.  $R^2 = 0.29$ ). The

model's success rate is 80%, which can be considered high. When interpreting the significant factors, it was found that high ESR levels ( $30.73 \pm 20.34$  mm/h) increase the likelihood of *H. pylori* Ig A positivity by 3.08 times (95% confidence interval [CI]: 2.05-4.11). The increased age of patients ( $48.65 \pm 11.29$  years) increases the likelihood of *H. pylori* Ig A positivity by 2.52 times (95% CI: 1.49-3.55). Lower magnesium levels in patients ( $1.95 \pm 0.09$  mEq/L) increase the likelihood of *H. pylori* Ig A positivity by 2.82 times (95% CI: 1.05-2.88).

Upon reviewing the results, the logistic regression analysis for *H. pylori* Ig G positivity revealed that hip involvement, age, and uveitis were significant risk factors for *H. pylori* Ig G positivity ( $P < 0.05$ ). Age and uveitis increased the likelihood of *H. pylori* Ig G positivity (Table 6). The ability of the variables hip involvement, age, and the presence of uveitis to explain the risk of *H. pylori* Ig G positivity was found to be 25% (Neg.  $R^2 = 0.25$ ). The model's success rate is 76%, which can be considered moderately high. When interpreting the significant factors, it was found

**TABLE 4. Measures of Positivities of Antibodies of *H. Pylori* IgA and *H. Pylori* Ig G**

	<i>H. pylori</i> IgA			<i>H. pylori</i> Ig G		
	Negative	Positive	P-value	Negative	Positive	P-value
Age (years)	45.07±12.28	48.65±11.29	<b>0.03*</b>	44.89±12.3	47.89±11.6	<b>0.04*</b>
Disease duration (years)	7.22±9.13	8.79±9.44	0.28	7.08±8.5	8.49±9.81	0.59
Glucose (mg/dL)	100.2±21.27	100.31±24.57	0.79	102.05±27.41	98.87±18.32	0.74
Creatinin (mg/dL)	0.71±0.17	0.73±0.17	0.31	0.71±0.18	0.72±0.16	0.33
ALT (U/L)	21.43±14.77	20.79±10.78	0.93	22.63±16.28	20.05±10.19	0.39
ESR (mm/h)	24.09±15.52	30.73±20.34	<b>0.01*</b>	25.57±19.38	27.94±16.88	0.10
CRP (mg/dL)	5.24±7.57	4.57±5.18	0.71	5.52±7.93	4.53±5.49	0.28
Magnesium (mEq/L)	2.01±0.05	1.95±0.09	<b>0.03*</b>	1.99±0.19	1.98±0.15	0.79
BASDAI	4.57±5.95	3.74±2.64	0.20	4.71±6.71	3.84±2.63	0.27

Data are shown as mean±standard deviation or n (%). ALT, alanine aminotransferase; BASDAI, bath ankylosing spondylitis disease activity index; CRP, c-reactive protein; ESR, erythrocyte sedimentation rate; *H. pylori*, *helicobacter pylori*. \*\*Independent samples t-test analysis, \*0.05: significant difference at the 0.05 level.

Statistically significant P-values are shown in bold.

that patients with hip involvement have a 3.48 times higher likelihood of *H. pylori* Ig G positivity (95% CI: 1.52-6.04). The higher age of patients (48.65±11.29 years) increases the likelihood of *H. pylori* Ig G positivity by 2.40 times (95% CI: 1.43-3.46). The presence of uveitis (1.95±0.09) increases the likelihood of *H. pylori* Ig G positivity by 1.61 times (95% CI: 1.05-2.22).

## DISCUSSION

Through this retrospective cohort study, we have identified several potential associations between *H. pylori* seropositivity and AS, including anti-*H. pylori* Ig A (age, ESR, serum magnesium) and anti-*H. pylori* Ig G (age, uveitis, hip involvement). To the best of our

knowledge, this study is the first to analyze the association between *H. pylori* and the characteristics of AS. One of the most intriguing findings of this study is that uveitis is associated with *H. pylori* Ig G seropositivity. Literature suggests that *H. pylori* infection is linked to undifferentiated anterior uveitis, while the data connecting *H. pylori* infection to AS remains conflicting. Otasevic et al. [18] explored the presence of *H. pylori* in patients with acute anterior uveitis (AAU) and SpA. All three patient groups (66.7% in the AAU group, 73.3% in the SpA group, and 80% in the AAU+SpA group) exhibited a higher percentage of *H. pylori* positivity compared to healthy controls, with only 26.7% of controls being anti-*H. pylori* positive, indicating a statistically significant difference between the patient and control groups (P<0.05) [18]. A prospective, cross-sectional, and

**TABLE 5. Determination of Risk Levels for *H. pylori* Ig A Positivity**

Variables	W	P-value	β (Risk level)	95% CI (β)
ESR	4.11	<b>0.03*</b>	3.08	2.05-4.11
Age	3.42	<b>0.03*</b>	2.52	1.49-3.55
Magnesium	2.12	<b>0.04*</b>	1.82	1.05-2.88

CI, confidence Interval for the risk level; ESR, erythrocyte sedimentation rate; *H. pylori*, *helicobacter pylori*

\*Logistic regression analysis, significant risk factors β=risk level. Statistically significant P-values are shown in bold.

**TABLE 6. Determination of Risk Levels for *H. Pylori* Ig G Positivity**

Variables	W	P-value	$\beta$ (Risk level)	95% CI ( $\beta$ )
Hip Involvement	5.58	<b>0.04*</b>	3.48	1.52–6.04
Age	3.12	<b>0.04*</b>	2.40	1.43–3.46
Uveitis	3.52	<b>0.04*</b>	1.61	1.05–2.22

CI, confidence interval for the risk level; *H. pylori*, *helicobacter pylori*

\*Logistic regression analysis, significant risk factors  $\beta$ =risk level. Statistically significant P-values are shown in bold.

comparative study also demonstrated a direct association between undifferentiated non-granulomatous uveitis and *H. pylori* Ig G titers [19]. Although the seroprevalence of *H. pylori* in uveitis has been reported to be increased in several studies, the potential role of *H. pylori* in the pathogenesis of uveitis remains unclear [20]. In our study, this may indicate a comorbidity or even an interaction, suggesting that AS patients with concomitant *H. pylori* infection are more likely to develop uveitis. Given that patients with prior experiences of uveitis and a higher number of uveitis flares were not included in this study, establishing a clear cause-and-effect relationship is challenging retrospective studies. In addition to uveitis, hip involvement was also found to be related to *H. pylori* Ig G positivity in our study. While no direct studies have yet explored the association between *H. pylori* seropositivity and hip joint involvement in AS, the existing evidence supports a potential link between chronic infections and more severe disease phenotypes. Given that hip involvement is considered a marker of advanced or refractory AS, it is plausible to hypothesize that *H. pylori* -related systemic inflammation may contribute to such clinical manifestations. It remains unclear to what extent the longer disease duration, more frequent exposure to medications, and older patient population may have contributed to the observed high prevalence. Furthermore, the limited number of patients exhibiting hip involvement (n=24) substantially hindered the ability to conduct a robust statistical analysis within this subgroup.

A recent review conducted in China indicates that the prevalence of *H. pylori* is notably higher in the elderly, with rates nearly double those observed in younger individuals 28.0% (95% CI: 23.9-32.5%) in children and adolescents compared to 46.1% (95% CI:

44.5-47.6%) in adults [21]. Considering both *H. pylori* and host-microbe interactions, it is known that this bacterium has coexisted with modern humans for millennia [22]. A study conducted in Brazil also reported an increased *H. pylori* prevalence associated with age, independent of sex [23]. In our study, advanced age was similarly observed as a risk factor for both *H. pylori* Ig A and Ig G positivity, likely due to an increased risk of possible exposure among patients.

The induction of low-grade inflammation due to *H. pylori* has been hypothesized as one of the pathogenic mechanisms underlying various extragastric manifestations of *H. pylori* [24]. Inflammation markers such as ESR and C-reactive protein (CRP) have been shown to correlate with gut microbiota; for instance, a positive correlation exists between Bacteroidetes abundance and CRP/ESR, while a negative correlation is observed between Firmicutes and CRP/ESR [25]. High serum levels of CRP and TNF- $\alpha$  were reported in preeclamptic women who were seropositive for *H. pylori* compared to seronegative subjects [26]. Unfortunately, the existing literature on this subject presents inconsistent and sometimes contradictory findings. A cross-sectional cohort study revealed no interaction between systemic inflammation and *H. pylori*, investigating CRP levels, neutrophil/lymphocyte ratio (NLR), and platelet/lymphocyte ratio (PLR) to assess systemic inflammation [27]. On the contrary, Sağlam et al. found an increased neutrophil count and PLR in individuals positive for *H. pylori* [28]. In our study, the relationship between elevated ESR and positive *H. pylori* IgA levels was found to be statistically significant.

One review suggests that *H. pylori* infection may alter magnesium levels in patients with renal disease,

although the underlying mechanisms remain unconfirmed [29]. Hafizi et al. [30] investigated the association between serum magnesium levels and *H. pylori* in a cross-sectional study involving stable kidney transplant patients. They utilized the urea breath test (UBT) to detect *H. pylori* and found higher magnesium levels in *H. pylori*-positive patients [30]. However, no significant relationship was found between serum *H. pylori*-IgG antibody titers and serum magnesium levels in patients with type 2 diabetes mellitus and chronic kidney disease [31]. Conversely, Öztürk et al. [32] reported significantly lower serum magnesium levels in *H. pylori* positive children compared to healthy controls. Considering all these conflicting data, establishing a clear relationship is challenging; however, in our study, hypomagnesemia was identified as a risk factor for *H. pylori* Ig A positivity. Although the use of proton pump inhibitors (PPIs) has not been studied across the entire cohort, the induction of hypomagnesemia by PPIs is a well-documented phenomenon, and this relationship is dose-dependent [33]. However, our study does not clarify whether hypomagnesemia is associated with PPI, which should be acknowledged as a limitation. Therefore, the observed association between *H. pylori* Ig A and magnesium levels may not be directly related to AS itself. It is possible that *H. pylori*-infected patients are more likely to utilize PPIs, and this likelihood may be even higher among AS patients, given their more frequent use of nonsteroidal anti-inflammatory drugs (NSAIDs).

On the other hand, the greatest genetic predisposition towards AS is known to be associated with the presence of HLA-B27 positivity [34]. The significance of gut microbiota is crucial in the pathogenesis of axSpA [35]. A recent meta-analysis demonstrated a strong association between infections and the development of AS through case-control and cohort studies [8]. Environmental factors may contribute to the disease's manifestation in genetically predisposed individuals, resulting in dysbiosis [36]. Recent studies have also found no correlation between disease activity and *H. pylori* in AS patients. Only 22.2% of patients with active AS were positive for *H. pylori* in stool samples. In our study, there was no significant effect of HLA-B27 positivity or BASDAI on *H. pylori* Ig A and *H. pylori* Ig G positivity.

## Strengths and Limitations

We utilized serum *H. pylori* antibody tests, while *H. pylori* stool antigen tests, urea breath test, or invasive tests offer more accurate and quicker detections. The sensitivity and specificity of the *H. pylori* antibody tests are lower. We consider this to be one of the major limitations of the study. Nevertheless, serological tests are widely used and less expensive non-invasive tests for diagnosing *H. pylori* infection. They are more appropriate for population screening than for diagnostic purposes. Relying solely on serological tests to assess *H. pylori* infection status poses limitations, particularly in the absence of confirmatory testing (e.g., urea breath test or stool antigen). The lack of confirmation of infection presence via the aforementioned tests can be considered a weakness of the study. Furthermore, this study represents a single-center experience and includes a relatively small patient population. As this study was based on retrospective data, a causal relationship cannot be established. As previously mentioned, the limited number of patients with hip joint involvement precluded further subgroup analyses within this cohort. In patients with a history of uveitis, those with recurrent episodes and those with a single episode were grouped together, thereby preventing the formation of a homogeneous subgroup. Moreover, the inclusion of only those patients with available *H. pylori* antibody test results in the hospital system introduces a potential selection bias. Additionally, the lack of data regarding PPI use posed a challenge in interpreting serum magnesium levels, as PPIs are known to affect magnesium homeostasis.

One of the main strengths of this study is the use of a well-defined patient group without comorbidities, which reduces confounding and allows a clearer understanding of disease-related associations. The relatively large sample size also increases the reliability of the results. In addition, the use of multivariable logistic regression makes the analysis stronger by identifying independent factors linked to seropositivity in a clear and systematic way.

## CONCLUSION

As observed in our study, increased age may be risk factor for exposure to *H. pylori*. Patients with elevated

ESR or hypomagnesemia may be monitored closely for accompanying *H. pylori* infection. The presence of uveitis or hip involvement may serve as predictive indicators for *H. pylori* infection. Understanding the role of *H. pylori* in AS could provide valuable insights into the disease's progression and facilitate the development of more effective treatment strategies. Further investigations with larger patient cohorts are necessary to deepen our understanding of its potential influence on AS pathophysiology.

#### *Ethics Approval and Consent to Participate*

This study was approved by the Pamukkale University Non-Interventional Clinical Research Ethics Committee (Decision No: 2019/20; date: 19.11.2019). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Informed consent was waived because of the retrospective nature of the study and the analysis used anonymous clinical data.

#### *Data Availability*

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

#### *Authors' Contribution*

Study Conception: FV; Study Design: FV; Supervision: FV, VÇ; Funding: FV; Materials: FV; Data Collection and/or Processing: FV; Statistical Analysis and/or Data Interpretation: FV; Literature Review: FV, VÇ; Manuscript Preparation: FV and Critical Review: FV, VÇ.

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## REFERENCES

1. Leja M, Grinberga-Derica I, Bilgiler C, Steininger C. Review: Epidemiology of Helicobacter pylori infection. *Helicobacter*. 2019;24 Suppl 1:e12635. doi: 10.1111/hel.12635.
2. Gu J, He F, Clifford GM, et al. A systematic review and meta-analysis on the relative and attributable risk of Helicobacter pylori infection and cardia and non-cardia gastric cancer. *Expert Rev Mol Diagn*. 2023;23(12):1251-1261. doi: 10.1080/14737159.2023.2277377.
3. Chen YC, Malfertheiner P, Yu HT, et al. Global Prevalence of Helicobacter pylori Infection and Incidence of Gastric Cancer Between 1980 and 2022. *Gastroenterology*. 2024;166(4):605-619. doi: 10.1053/j.gastro.2023.12.022.
4. Etcheagaray-Morales I, Jiménez-Herrera EA, Mendoza-Pinto C, et al. Helicobacter pylori and its association with autoimmune diseases: systemic lupus erythematosus, rheumatoid arthritis and Sjögren syndrome. *J Transl Autoimmun*. 2021;4:100135. doi: 10.1016/j.jtauto.2021.100135.
5. Wang L, Cao ZM, Zhang LL, et al. Helicobacter Pylori and Autoimmune Diseases: Involving Multiple Systems. *Front Immunol*. 2022;13:833424. doi: 10.3389/fimmu.2022.833424.
6. Radić M. Role of Helicobacter pylori infection in autoimmune systemic rheumatic diseases. *World J Gastroenterol*. 2014;20(36):12839-12846. doi: 10.3748/wjg.v20.i36.12839.
7. Hwang MC, Ridley L, Reveille JD. Ankylosing spondylitis risk factors: a systematic literature review. *Clin Rheumatol*. 2021;40(8):3079-3093. doi: 10.1007/s10067-021-05679-7.
8. Zhang X, Sun Z, Zhou A, et al. Association Between Infections and Risk of Ankylosing Spondylitis: A Systematic Review and Meta-Analysis. *Front Immunol*. 2021;12:768741. doi: 10.3389/fimmu.2021.768741.

9. Su QY, Zhang Y, Qiao D, et al. Gut microbiota dysbiosis in ankylosing spondylitis: a systematic review and meta-analysis. *Front Cell Infect Microbiol.* 2024;14:1376525. doi: [10.3389/fcimb.2024.1376525](https://doi.org/10.3389/fcimb.2024.1376525).
10. Bartels LE, Pedersen AB, Kristensen NR, Vilstrup H, Stengaard-Pedersen K, Dahlerup JF. A positive *Helicobacter pylori* test is associated with low spondylarthritides incidence in a Danish historical cohort study. *Rheumatol Int.* 2020;40(3):359-366. doi: [10.1007/s00296-019-04487-2](https://doi.org/10.1007/s00296-019-04487-2).
11. İnal EE, Aynalı A, Çanak S, et al. The Impacts of *Helicobacter Pylori* Antigen Positivity on Ankylosing Spondylitis. *J Clin Anal Med* 2016;7(3): 327-30. doi: [10.4328/JCAM.2767](https://doi.org/10.4328/JCAM.2767).
12. Bilici R, Alp GT, Çelikdelen SÖ, Öztürk MA, Kekilli M. TNF inhibitor resistance in ankylosing spondylitis: is *Helicobacter pylori* the overlooked culprit? *Clin Rheumatol.* 2025;44(8):3201-3207. doi: [10.1007/s10067-025-07536-3](https://doi.org/10.1007/s10067-025-07536-3).
13. Moll JM, Wright V. New York clinical criteria for ankylosing spondylitis. A statistical evaluation. *Ann Rheum Dis.* 1973;32(4):354-363. doi: [10.1136/ard.32.4.354](https://doi.org/10.1136/ard.32.4.354).
14. Albrecht J, Müller HA. HLA-B27 typing by use of flow cytometry. *Clin Chem.* 1987;33(9):1619-1623. doi: [10.1093/clin/33.9.1619](https://doi.org/10.1093/clin/33.9.1619).
15. Bönisch A, Ehlebracht-König I. [The BASDAI-D--an instrument to defining disease status in ankylosing spondylitis and related diseases]. *Z Rheumatol.* 2003;62(3):251-263. doi: [10.1007/s00393-003-0519-6](https://doi.org/10.1007/s00393-003-0519-6). [Article in German]
16. Dhar R, Mustafa AS, Dhar PM, et al. Evaluation and comparison of two immunodiagnostic assays for *Helicobacter pylori* antibodies with culture results. *Diagn Microbiol Infect Dis.* 1998;30(1):1-6. doi: [10.1016/s0732-8893\(97\)00178-8](https://doi.org/10.1016/s0732-8893(97)00178-8).
17. Lu J, Van Hoang D, Hayashi Y, et al. Negative-High Titer of *Helicobacter pylori* Antibody and Lipid Profiles. *Biomed Res Int.* 2022;2022:9984255. doi: [10.1155/2022/9984255](https://doi.org/10.1155/2022/9984255).
18. Otasevic L, Zlatanovic G, Stanojevic-Paovic A, et al. *Helicobacter pylori*: an underestimated factor in acute anterior uveitis and spondyloarthropathies? *Ophthalmologica.* 2007;221(1):6-13. doi: [10.1159/000096515](https://doi.org/10.1159/000096515).
19. Pérez-Cano HJ, Ceja-Martínez J, Tellezgirón-Lara V, Voorduin-Ramos S, Morales-López O, Somilleda-Ventura SA. Relationship between *Helicobacter pylori* and undifferentiated non-granulomatous anterior uveitis. *Infection.* 2023;51(3):765-768. doi: [10.1007/s15010-022-01970-0](https://doi.org/10.1007/s15010-022-01970-0).
20. Markov G, Zdravkov Y, Oscar A. *Helicobacter pylori* and uveitis: a brief narrative literature review. *Sriwijaya J Ophthalmol.* 2023;6(2):276-278. doi: [10.37275/sjo.v6i2.109](https://doi.org/10.37275/sjo.v6i2.109).
21. Ren S, Cai P, Liu Y, et al. Prevalence of *Helicobacter pylori* infection in China: A systematic review and meta-analysis. *J Gastroenterol Hepatol.* 2022;37(3):464-470. doi: [10.1111/jgh.15751](https://doi.org/10.1111/jgh.15751).
22. Moodley Y, Linz B, Bond RP, et al. Age of the association between *Helicobacter pylori* and man. *PLoS Pathog.* 2012;8(5):e1002693. doi: [10.1371/journal.ppat.1002693](https://doi.org/10.1371/journal.ppat.1002693).
23. Zaterka S, Eising JN, Chinzon D, Rothstein W. Factors related to *Helicobacter pylori* prevalence in an adult population in Brazil. *Helicobacter.* 2007;12(1):82-88. doi: [10.1111/j.1523-5378.2007.00474.x](https://doi.org/10.1111/j.1523-5378.2007.00474.x).
24. Franceschi F, Gasbarrini A, Polyzos SA, Kountouras J. Extragastric Diseases and *Helicobacter pylori*. *Helicobacter.* 2015 Sep;20 Suppl 1:40-46. doi: [10.1111/hel.12256](https://doi.org/10.1111/hel.12256).
25. Liu G, Hao Y, Yang Q, Deng S. The Association of Fecal Microbiota in Ankylosing Spondylitis Cases with C-Reactive Protein and Erythrocyte Sedimentation Rate. *Mediators Inflamm.* 2020;2020:8884324. doi: [10.1155/2020/8884324](https://doi.org/10.1155/2020/8884324).
26. UstUn Y, Engin-UstUn Y, Ozkaplan E, Otlu B, Sait TekerekoGlu M. Association of *Helicobacter pylori* infection with systemic inflammation in preeclampsia. *J Matern Fetal Neonatal Med.* 2010;23(4):311-4. doi: [10.3109/14767050903121456](https://doi.org/10.3109/14767050903121456).
27. Kim TJ, Pyo JH, Lee H, et al. Lack of Association between *Helicobacter pylori* Infection and Various Markers of Systemic Inflammation in Asymptomatic Adults. *Korean J Gastroenterol.* 2018(25);72(1):21-27. doi: [10.4166/kjg.2018.72.1.21](https://doi.org/10.4166/kjg.2018.72.1.21).
28. Sağlam NÖ, Civan HA. Impact of chronic *Helicobacter pylori* infection on inflammatory markers and hematological parameters. *Eur Rev Med Pharmacol Sci.* 2023;27(3):969-979. doi: [10.26355/eurrev\\_202302\\_31190](https://doi.org/10.26355/eurrev_202302_31190).
29. Yalameha B, Nasri P. *Helicobacter pylori* infection and serum magnesium in kidney disease; current concepts. *J Nephropharmacol.* 2019;9(1): e11. doi: [10.15171/npj.2020.11](https://doi.org/10.15171/npj.2020.11).
30. Hafizi M, Mardani S, Borhani A, Ahmadi A, Nasri P, Nasri H. Association of *Helicobacter pylori* infection with serum magnesium in kidney transplant patients. *J Renal Inj Prev.* 2014(1);3(4):101-105. doi: [10.12861/jrip.2014.29](https://doi.org/10.12861/jrip.2014.29).
31. Baradaran A, Nasri H. *Helicobacter pylori* specific IgG antibody and serum magnesium in type-2 diabetes mellitus chronic kidney disease patients. *Saudi J Kidney Dis Transpl.* 2011;22(2):282-285.
32. Öztürk N, Kurt N, Özgeriş FB, et al. Serum Zinc, Copper, Magnesium and Selenium Levels in Children with *Helicobacter Pylori* Infection. *Eurasian J Med.* 2015;47(2):126-129. doi: [10.5152/eurasianjmed.2015.104](https://doi.org/10.5152/eurasianjmed.2015.104).
33. Srinutta T, Chewcharat A, Takkavatakarn K, et al. Proton pump inhibitors and hypomagnesemia: A meta-analysis of observational studies. *Medicine (Baltimore).* 2019;98(44):e17788. doi: [10.1097/MD.0000000000017788](https://doi.org/10.1097/MD.0000000000017788).
34. Liu Y, Jiang L, Cai Q, et al. Predominant association of HLA-B\*2704 with ankylosing spondylitis in Chinese Han patients. *Tissue Antigens.* 2010;75(1):61-64. doi: [10.1111/j.1399-0039.2009.01379.x](https://doi.org/10.1111/j.1399-0039.2009.01379.x).
35. Liu G, Ma Y, Yang Q, Deng S. Modulation of inflammatory response and gut microbiota in ankylosing spondylitis mouse model by bioactive peptide IQW. *J Appl Microbiol.* 2020;128(6):1669-1677. doi: [10.1111/jam.14588](https://doi.org/10.1111/jam.14588).
36. Berland M, Meslier V, Berreira Ibraim S, et al. Both Disease Activity and HLA-B27 Status Are Associated With Gut Microbiome Dysbiosis in Spondyloarthritis Patients. *Arthritis Rheumatol.* 2023;75(1):41-52. doi: [10.1002/art.42289](https://doi.org/10.1002/art.42289).

# Investigation of the Effect of EMDR Therapy on Psychosomatic Symptoms and Early Maladaptive Schemas: An Analysis of 5 Cases

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## Abstract:

**Objective:** This study examined the effects of Eye Movement Desensitization and Reprocessing (EMDR) therapy on psychosomatic symptoms and early maladaptive schemas.

**Methods:** This study used a single-group pretest-posttest multiple case design, conducted without a control group. Five voluntary participants aged 18 and over were selected via purposive sampling. Data were collected through a Demographic Information Form, the Young Schema Questionnaire, and the Somatization Scale(33 items, derived from the MMPI).

**Results:** All participants showed decreases in early maladaptive schemas and psychosomatic symptoms after EMDR therapy, indicating its effectiveness in reducing both cognitive and somatic distress.

**Conclusion:** EMDR therapy appears effective in alleviating psychosomatic symptoms and maladaptive schemas. These findings support its clinical use and highlight the need for further research with larger samples.

**Keywords:** EMDR, Psychosomatic Symptom, Early Maladaptive Schemas, Psychosomatization

Schema-focused therapy methods center on intervening in early maladaptive schemas, which Young [1] described as highly fixed, permanent beliefs that hinder treatment. Schema therapy posits that these schemas originate in early childhood [2], encompassing memories, cognitions, emotions, and bodily sensations causing functional impairments. Eye movement desensitization and reprocessing (EMDR) therapy primarily targets memories and intrusive thoughts, activating negative beliefs - early maladaptive schemas - via memory processing according to the adaptive information processing (AIP) model.

The AIP model integrates unresolved negative

memories into existing memory networks; failure causes disconnection and psychopathology [3]. EMDR facilitates reprocessing through bilateral stimulation, organizing memories semantically and promoting positive cognitions [4]. Mares [5] linked early maladaptive schemas to core beliefs formed in early childhood. Schema therapy highlights that unmet emotional needs lead to pathology and unconscious negative coping [6]. These schemas arise from conscious and unconscious emotional and physical domains [7].

Numerous studies report positive physical and psychological outcomes after EMDR. Van Rood and de Roos [8] associated EMDR with improvements in

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unexplained chronic pain. Tesarz *et al.* [9] emphasized psychosocial factors and emotional processing deficits in chronic pain, concluding EMDR alleviates psychosomatic symptoms.

Early maladaptive schemas are shaped by adverse childhood experiences and contribute to psychosomatic symptoms [10]. EMDR therapy may reduce their impact by targeting core cognitions. Unlike schema therapy's long-term focus, EMDR offers faster processing of underlying trauma. The aim of this study is to examine the effects of EMDR therapy on early maladaptive schemas and psychosomatic symptoms. Unlike schema therapy, which involves a long-term treatment process, EMDR provides a relatively rapid reprocessing of traumatic memories. By focusing on this distinction, the study seeks to contribute to the limited body of literature investigating the impact of EMDR on both schemas and psychosomatic complaints.

## METHODS

### Model

Since the study aimed to examine the effect of EMDR therapy on psychosomatic symptoms and early maladaptive schemas, a quasi-experimental pretest-posttest design without a control group was used [11]. In this design, participants are measured with the same dependent variables before and after the experimental procedure [12].

### Population and Sample

The study included five voluntary participants aged 18 and over, who presented with psychosomatic symptoms. Participants were selected using purposive sampling based on specific inclusion and exclusion criteria. The inclusion criteria were being 18 years or older, experiencing psychosomatic complaints, and providing informed consent to participate in the study. Participants were excluded if they had severe psychiatric disorders such as psychosis or major depression, were undergoing ongoing psychotherapy or pharmacotherapy that could interfere with EMDR, had neurological disorders, or were unable to attend the full intervention sessions. Data were collected on demographic characteristics, early maladaptive schemas, and psychosomatic symptoms using a

Demographic Information Form, the Young Schema Questionnaire, and the Somatization Scale.

### Data Collection Tools

In this study, demographic information form, Young Schema Scale- Form 3 and Minnesota Multiphasic Personality Inventory somatization subscale was used to collect data.

### Demographic Information Form

This form consists of 11 questions and includes demographic information such as gender, age, education etc., as well as whether the participant has a chronic or psychological disorder.

### Young Schema Scale

In this form developed by Jeffrey Young [7] based on Schema Therapy, 18 dimensions covering the schema areas of Disconnection and Rejection, Impaired Autonomy and Self-Exposure, Impaired Boundaries, Other Orientation, Hyper-vigilance and Repression are proposed. This scale includes 90 items and is graded on a 6-point Likert scale. Soygüt *et al.* [13] studied its reliability and validity in Turkey.

### Somatization Scale (33 items, derived from the MMPI)

The Somatization Scale was developed by selecting 33 items related to somatization disorder from the Minnesota Multiphasic Personality Inventory (MMPI). Its validity and reliability in Turkey were examined by Dülgerler (unpublished master's thesis, 2000). The internal consistency reliability coefficient was 0.83, the test-retest reliability coefficient was 0.996, the first-half Alpha value was 0.8810, the second-half Alpha value was 0.8439, and its correlation with the SCL-90-R somatization subscale was 0.80. The scale includes both positively and negatively worded items, each answered as either "true" or "false." Total scores range from 0 to 33, with higher scores indicating greater somatization symptoms.

### Process

This study was approved by the İstanbul Aydın University Social and Human Sciences Ethics

Committee (Decision No: 2023/10; date: 21.12.2023). Five volunteers with psychosomatic symptoms were selected via purposive sampling from 5N1K Psychoacademy. Informed consent was obtained. Participants received eight weekly EMDR sessions over two months. Pre- and post-assessments were conducted. The study is adapted from the second author's master's thesis.

### Statistical Analysis

In this study, statistical analyses were evaluated using SPSS 27 software. The pre-test and post-test scores of the Somatization Scale and Young Schema Scale for each participant were calculated and presented in the form of a descriptive table.

## RESULTS

### PARTICIPANT 1

#### History Taking Phase (SESSIONS 1-2)

Participant M.Y., a 28-year-old single university graduate from Istanbul, reported difficulties in romantic relationships, anger issues, and recurrent headaches with no medical diagnosis. She described herself as worthless and undeserving of love due to traumatic experiences and emotional distress. Based on these factors, the Young Schema Questionnaire and Somatization Scale were administered, and EMDR therapy was initiated to target both somatic symptoms and early maladaptive schemas.

#### Participant 1 Formulation

**A. I am incompetent**

**First memory:** Being offended by the teacher in primary school because of a question he did not know (Subjective Units of Disturbance [SUD] 7)

**Worst memory:** Abuse experienced at age 7-8 (SUD 9)

**Last memory:** Unable to prevent a partner from attempting intimacy against her will (SUD 8)

**Any other memories:** —

**B. I'm worthless**

**First memory:** Abuse experienced at age 7-8 (SUD 9)

**Worst memory:** Abuse experienced at age 7-8 (SUD 9)

**Last memory:** Attempted intimacy without

consent of last partner (SUD 7)

**Any other memories:** —

**C. I am helpless**

**First memory:** Abuse experienced at age 7-8 (SUD 9)

**Worst memory:** Abuse experienced at age 7-8 (SUD 9)

**Last memory:** Attempted intimacy without consent of last partner (SUD 7)

**Any other memories:** Moments when her mother touched her body without her consent (SUD 6)

**Note:** Headache and physical sensations were reported for all memories.

#### Preparation Phase: SESSION 3

At this stage, she was informed about EMDR therapy and relaxation exercises were applied.

#### Evaluation Phase: SESSION 4

In this session, the participant's target memory and associated elements—including the image, negative and positive cognitions, Validity of Cognition (VOC), emotion, SUD, and body sensations—were evaluated. The negative belief identified was “I am helpless,” and the target image was “the moment the perpetrator placed M.Y. on his lap and touched her genital area,” selected as both the earliest and most distressing memory. Current triggers included her boyfriend's unsolicited physical advances, cohabitation with the perpetrator, emotionally neglectful behavior from her mother, and exposure to abuse scenes in media.

#### Desensitization Phase: SESSION 5

She experienced intense crying during the initial sets. The memory unfolded with scenes such as “meeting in the parking lot” and “recognizing his voice in the apartment,” followed by sensory details like the tracksuit color and perfume scent. Although she showed no emotional expression afterward, she reported occasional headaches. As the target memory proved distressing and her SUD level remained at 8, the session was concluded using the incomplete session protocol.

#### SESSION 6

In this session, which started with the evaluation of the previous session, she mentioned that her

headaches continued and remembered memories about her mother between the sets. She scored her SUD as 6 and the session ended with a safe place exercise.

### SESSION 7

In this session, she continued her memories about her mother in the sets and towards the end of the sets, she made positive statements and stated her SUD score as 4.

### SESSION 8

At the beginning of the session, M.Y. reported only three vague headaches during the week and rated her SUD score as 3. Following 28 sets, she expressed positive shifts such as "I am free now; these experiences are in the past." With a final SUD score of 0 and noted physical relaxation, the session concluded by completing the past, present, and future phases of the EMDR protocol, including placement, body scan, closure, and reassessment.

## PARTICIPANT 2

### History Taking Phase (SESSIONS 1-2)

Participant O.L. is a 30-year-old married university graduate living with his family in Istanbul and is the youngest of two siblings. He reported difficulties in emotional closeness with his spouse, anger issues, and medically unexplained pain in his head, shoulders, and back. He also expressed challenges in setting boundaries, a need for constant approval, and traumatic experiences with his father. He described himself as unlovable, unsuccessful, and worthless, and reported difficulty initiating tasks without others' approval. Based on these factors, the Somatization Scale and Young Schema Questionnaire were administered, and EMDR therapy was initiated to address both somatic symptoms and early maladaptive schemas.

### Participant 2 Formulation

**A. I am incompetent**

**First memory:** When he was 8 years old, he was told to take care of his visually impaired brother (SUD 8)

**Worst memory:** When his recommended stock market purchases lost value and a senior figure called him to account (SUD 9).

**Last memory:** Having to pay the bill when his friend insisted on inviting him to dinner with guests from abroad (SUD 6)

**Any other memories:** —

**B. I'm worthless**

**First memory:** When he was 12 years old and his father did not come to the hospital during surgery (SUD 7)

**Worst memory:** At age 24, when he was at university, his father did not come to his graduation (SUD 9)

**Last memory:** At age 28, an argument with his wife during his military service (SUD 8)

**Any other memories:** —

**Note:** For all memories, the physical sensation of tightness in the throat was reported.

### Preparation Phase: SESSION 3

At the beginning of this session, he was given information about EMDR and relaxation exercises were practiced.

### Evaluation Phase: SESSION 3

During this stage, the participant's problem, memory, image, negative and positive cognitions, Validity of Cognition (VOC), emotion, SUD, and bodily sensations were evaluated. It was decided to start working with the belief of 'valuelism' by determining the first and worst memories. Current triggers included difficulties with his spouse, the fact that his close friend had moved away, ongoing difficulties in starting tasks, and not communicating with his father.

### Desensitization Phase: SESSION 4

He began the sets with crying and reported feeling sad. He focused on the memory of his father not coming to his graduation, recalling details such as "receiving the diploma on stage" and "his father not being there." The participant reported a SUD score of 6, and the session was concluded using the incomplete session protocol.

### SESSION 5

In this session, he reviewed the previous session and reported a SUD score of 4. The memory unfolded with scenes such as "seeing his mother alone" and

“everyone applauding and smiling at him,” leading to the emergence of positive cognitions. After 32 sets, he reported physical relaxation and a SUD score of 0. The three-phase EMDR protocol—installation, body scan, and closure—was completed for this memory. Since the initial phases of another target memory had already been conducted, he was reminded of it, and desensitization was scheduled for the following session.

## SESSION 6

In this session, the memory “when he was told to take care of his visually impaired brother at age 8” was selected, and his negative and positive cognitions, VOC, emotion, SUD, and body sensations were determined. He stated his negative cognition as “I am inadequate.” After reviewing the first and last memory, the desensitization phase was started.

### Desensitization Phase

When the target memory was activated, he reported a SUD score of 8 along with sensations of throat tightness and back pain. The memory unfolded through scenes such as “when the neighbors came over” and “when they turned to him while watching television and told him to take care of his brother.” He reported experiencing intense fear. Following 30 sets, he demonstrated a cognitive shift, stating, “It wasn’t my fault; I was a child. My family was responsible for taking care of me too,” and his SUD score decreased to 4. The session concluded using the incomplete session protocol.

## SESSION 7

In this session, he reported a SUD score of 0 related to the memory after the sets.

### Placement Phase: SESSION 8

The sets continued until the VOC score reached 7, and the past, present, and future phases of the EMDR protocol were completed for this memory, including the body scan, closure, and reassessment stages.

## PARTICIPANT 3

### History Taking Phase (SESSIONS 1-2-3)

Participant G.Y. is an 18-year-old single high

school senior living alone. She struggles with social communication and has low self-confidence in romantic relationships. Her father is perfectionistic, and her mother seeks constant approval. G.Y. feels inadequate, experiences anger and fear of failure, has communication issues with her father, and suffers from persistent headaches without medical diagnosis. Based on these factors, the Somatization Scale and Young Schema Questionnaire were administered, and EMDR therapy was initiated.

### Participant 3 Formulation

**A.** I am incompetent

**First memory:** Childhood experience of fecal incontinence (SUD 10)

**Worst memory:** Childhood experience of fecal incontinence (SUD 10)

**Last memory:** The moment her father yelled at her (SUD 9)

**Any other memories:** The first moment she appeared on stage (SUD 9)

**Note:** Physical sensations of headache were reported for all memories.

### Preparation Phase: SESSION 4

At this stage, she was informed about EMDR, and relaxation exercises were practiced.

### Evaluation Phase: SESSION 5

During this session, her problem was identified, and the first and worst memory was determined as “wetting herself in primary school.” The associated image, negative cognition, positive cognition, Validity of Cognition (VOC), emotion, SUD, and bodily sensations were assessed. Current triggers included ongoing exams at school, relatives’ ongoing success expectations, and comparisons with her older sister.

### Desensitization Phase: SESSION 6

When the selected memory was activated, it began with “the moment she started to sit in the classroom, the moment her teacher did not allow her to go to the toilet, the moment she felt wetness.” After 16 sets, she reported feelings of shrinkage, verbalized associated thoughts, and stated her SUD score as 8. The session was concluded using the incomplete session protocol.

## SESSION 7

In this session, she reported a recurring memory from the previous session. She described experiencing heart palpitations and physical stiffness when stepping onto the stage for a school presentation, which contributed to strong feelings of inadequacy. During the sets, she expressed anxiety with statements such as “I’m nervous, I’m afraid of forgetting my memorization” and reported a SUD score of 6. Due to emerging shoulder pain, the session was concluded using the incomplete session protocol.

## SESSION 8

In this session, she reported a significant decrease in body sensations and rated her SUD score as 4. After 25 sets, she made positive statements such as “My presentation was good; I deserved to be there.” When the SUD score reached 0, all three aspects of the EMDR protocol were completed, including memory placement, body scan, and reassessment.

## PARTICIPANT 4

### History Taking Phase (SESSIONS 1-2)

Participant M.B. is a 27-year-old single secondary school graduate and the youngest of three siblings. He works with his father but reported trust issues affecting his romantic relationships. He described communication problems with his father due to a significant age gap and his father's anger. He also stated that his mother is highly anxious and overreactive, and that his social circle is limited. Experiencing feelings of inadequacy, sudden anger, numbness, and unexplained waist, back, and headaches, the Somatization Scale and Young Schema Questionnaire were administered. Considering these traumatic memories, EMDR therapy was initiated.

### Participant 4 Formulation

**A.** I am incompetent

**First memory:** Being ostracized by his friends at the Armenian school in primary school (SUD 8)

**Worst memory:** His father telling him "you're nothing" at home (SUD 9)

**Last memory:** The moment he got angry with his father at work and punched the wall (SUD 8)

**Other memory if any:** When he was 15 years old,

his father yelled at him for a job he couldn't do (SUD 9)

**B.** I am worthless

**First memory:** When he was 7 years old, sharing a dream with his father and he belittled him (SUD 8)

**Worst memory:** When his father took away the prize money he had won (SUD 8)

**Last memory:** He had made plans for New Year's Eve but his family did not wake him up (SUD 7)

**Any other memories:** When his friends told him it was canceled even though they had made plans, but they met on their own (SUD 9)

**Note:** For all memories, physical sensations of headache, lower back and back pain, and numbness in the legs were reported.

### Preparation Phase: SESSION 3

In this session, he was informed about the functioning of EMDR therapy, and various relaxation exercises were applied.

### Evaluation Phase: SESSION 4

The participant's problems were identified, focusing on the memory “nothing will come of you” said by his father at home. The associated image, negative cognition (NC), positive cognition (PC), VOC, emotion, SUD, and bodily sensations were determined. Memories related to the belief “I am inadequate” were evaluated. Current triggers included ongoing problems with his father, the pressure from his anxious mother, and conflicts at work.

### Desensitization Phase: SESSION 5

In the first sets, he explored the source of the problems experienced with his father. In the following sets, he focused on “the moment his father yelled,” “the moment he felt guilty,” and “the moment his father said nothing would happen to him.” He reported a SUD level of 7, along with low back and back pain. The session was concluded using the incomplete session protocol.

### SESSION 6

The participant initially reported a SUD score of 5 related to the memory and, after the ongoing sets, reported 0 with a relaxed body. The placement, body scan, closure, and reassessment stages were completed

for this memory. Since the initial stages for another memory were completed beforehand, the targeted memory was addressed with desensitization in the next session.

## SESSION 7

In this session, the belief “I am worthless” was evaluated in detail through the memory “although his friends had plans, they met on their own without calling him.” The associated image, NC, PC, VOC, emotion, SUD, and bodily sensations were determined.

### Desensitization Phase

During the sets, he recalled memories such as “the moment they all got into the car together” and “the moment his friends told him that the plan was canceled.” He reported increasing shoulder and back pain, with a SUD level of 6.

## SESSION 8

The previous session was reviewed. Initially, he reported a SUD score of 4 and noted increased numbness at the start of the bilateral stimulation sets, followed by significant reduction after 10 sets. By the 17th set, he began expressing positive cognitions such as “I am not to blame” and “I am also valuable.” At the end of the processing, his SUD score decreased to 0. The EMDR protocol was completed by implementing the installation, body scan, closure, and reassessment phases related to the targeted memory.

## PARTICIPANT 5

### History Taking Phase (SESSIONS 1-2-3)

Participant F.T. is a 52-year-old lawyer and mother of two. She divorced at age 32 and currently works at a special education center. She sought therapy due to infidelity, crying spells, and unexplained headaches. Noting her dependent personality and the recent loss of her husband during therapy, she reported increasing feelings of helplessness. The Somatization Scale and Young Schema Questionnaire were administered, and considering her traumatic experiences and somatic symptoms, EMDR therapy was initiated.

### Participant 5 Formulation

#### A. I am helpless

**First memory:** When she was 7-8 years old and brought to the hospital before her sister's death (SUD 8)

**Worst memory:** Ex-husband sending wedding candy to her home (SUD 9)

**Last memory:** Ex-husband's wife calling and threatening her (SUD 9)

**Any other memories:** Her ex-husband taking her and the children in the car during the divorce, speeding and risking death (SUD 9)

**Note:** Physical sensations of headache were reported for all memories.

### Preparation Phase: SESSION 4

At this stage, she was informed about the functioning of the EMDR therapy process, and relaxation exercises were practiced.

### Evaluation Phase: SESSION 4

Negative beliefs and memories related to “I am helpless” were evaluated. The memory “ex-husband sending wedding candy to her house” was determined as the worst memory. Positive cognition, VOC, emotion, SUD, and bodily sensations were assessed. Current triggers included problems at work, contact with her ex-husband, and the recent loss of her husband after the fifth session.

### Desensitization Phase: SESSION 5

She experienced emotional difficulty following the recent loss of her ex-husband. During memory processing, she recalled distressing events such as seeing herself in a wedding dress and being accused of casting a spell on her son. After 25 sets of bilateral stimulation, a related memory emerged involving her children's father not attending their performance or taking them out to dinner. The session was concluded using the incomplete session protocol, as her SUD score remained at 7.

## SESSION 6

When reviewing the previous session, she reported her SUD score as 4. After the loss of her husband, she noted that the infidelity affected her less than before and initially reflected on her children being fatherless. Following 30 sets, she began making positive statements, her SUD score reached 0, and the past,

**TABLE 1. Young Schema Scale Pre-Test - Post-Test Results**

	Participant 1		Participant 2		Participant 3		Participant 4		Participant 5	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Emotional deprivation	21	14	20	16	9	8	23	17	20	12
Social isolation/insecurity	30	23	28	24	35	24	22	18	25	18
Defectiveness	24	15	14	12	19	18	7	7	6	6
Emotional inhibition	22	14	20	15	24	20	17	13	23	16
Dependence	22	20	24	23	21	20	18	16	20	18
Abandonment	10	10	12	12	24	17	8	7	9	7
Vulnerability to harm	19	14	15	13	21	19	12	10	22	13
Failure	16	14	23	17	20	20	15	11	8	8
Negativism	13	11	13	10	18	13	14	13	12	6
Entitlement /Insufficient self-control	25	22	23	20	27	25	29	23	27	22
Self-sacrifice	12	10	22	16	12	9	15	12	7	6
Punitiveness	7	6	14	13	28	24	29	19	13	12
Unrelenting standards	9	7	15	9	18	16	10	8	10	7
Approval seeking	16	15	30	23	35	29	16	12	20	16

present, and future phases of the EMDR protocol were completed, including placement, body scan, closure, and reassessment. Another target memory was prepared for the next session, and desensitization was initiated.

**SESSION 7**

The memory “her ex-husband not coming to pick up her children” was selected. Her associated image, negative cognition, positive cognition, VOC, emotion, SUD, and bodily sensations were assessed.

**Desensitization Phase**

She reported a SUD score of 8 when the memory was activated. After 25 sets, she processed memories related to her husband’s departure and verbalized statements such as “you are no longer there, you hugged and left, you died, I forgave you.” The session ended with the incomplete session protocol.

**SESSION 8**

After 37 sets, she reported a SUD score of 4 and began making positive statements such as “I wish for happy events, I am enough.” By the end of the sets, her SUD score reached 0. The EMDR protocol was completed, including placement, body scan, closure, and reassessment phases.

**Findings Related to Participants' Young Schema Scale Scores**

When the findings related to the Table 1 are examined, the pre-test score of Emotional Deprivation schema of participant 1 is 21, post-test score is 14, the pre-test score of Social isolation/insecurity schema is 30, post-test score is 23, the pre-test score of Defectiveness schema is 24, post-test score 15, Emotional Inhibition schema pre-test score 22, post-test score 14, Dependence pre-test score 22, post-test score 20, Abandonment schema pre-test score 10, post-test score 10, Vulnerability to harm schema pre-test score 19, post-test score 14, Failure schema pre-test score 16, post-test score 14, Negativism schema pre-test score 13, post-test score 11, Entitlement /Insufficient Self-control schema pre-test score 25, post-test score 22, Self-Sacrifice schema pre-test score 12, post-test score 10, Punitiveness schema pre-test score 7, post-test score 6, Unrelenting

**TABLE 2. Somatization Scale Pre-Test - Post-Test Results**

	Participant 1		Participant 2		Participant 3		Participant 4		Participant 5	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Somatization scale	27	9	22	7	29	9	25	7	26	8

standards schema pre-test score 9, post-test score 7, Approval seeking pre-test score 16, post-test score 15.

For participant 2, Emotional Deprivation schema pre-test score was 20, post-test score was 16, Social isolation/insecurity schema pre-test score was 28, post-test score was 24, Defectiveness schema pre-test score was 14, post-test score 12, Emotional Inhibition schema pre-test score was 20, post-test score 15, Dependence pre-test score was 24, post-test score 23, Abandonment schema pre-test score was 12, post-test score 12, Vulnerability to harm schema pre-test score was 15, post-test score 13, Failure schema pre-test score 23, post-test score 17, Negativism schema pre-test score 13, post-test score 10, Entitlement /Insufficient Self-control schema pre-test score 23, post-test score 20, Self-Sacrifice schema pre-test score 22, post-test score 16, Punitiveness schema pre-test score 14, post-test score 13, Unrelenting standards schema pre-test score 15, post-test score 9, Approval seeking pre-test score 30, post-test score 23.

For participant 3, Emotional Deprivation schema pre-test score was 9, post-test score 8, Social isolation/insecurity schema pre-test score was 35, post-test score 24, Defectiveness schema pre-test score was 19, post-test score 18, Emotional Inhibition schema pre-test score 24, post-test score 20, Dependence pre-test score was 21, post-test score was 20, Abandonment schema pre-test score 24, post-test score 17, Vulnerability to harm schema pre-test score was 21, post-test score 19, Failure schema pre-test score 20, post-test score 20, Negativism schema pre-test score 18, post-test score 13, Entitlement /Insufficient Self-control schema pre-test score 27, post-test score 25, Self-Sacrifice schema pre-test score 12, post-test score 9, Punitiveness schema pre-test score 28, post-test score 24, Unrelenting standards schema pre-test score 18, post-test score 16, Approval seeking pre-test score 35, post-test score 29.

For Participant 4, Emotional Deprivation schema pre-test score was 23, post-test score 17, Social

isolation/insecurity schema pre-test score was 22, post-test score 18, Defectiveness schema pre-test score was 7, post-test score 7, Emotional Inhibition schema pre-test score 17, post-test score 13, Dependence pre-test score was 18, post-test score 16, Abandonment schema pre-test score 8, post-test score 7, Vulnerability to harm schema pre-test score 12, post-test score 10, Failure schema pre-test score 15, post-test score 11, Negativism schema pre-test score 14, post-test score 13, Entitlement /Insufficient Self-control schema pre-test score 29, post-test score 23, Self-Sacrifice schema pre-test score 15, post-test score 12, Punitiveness schema pre-test score 29, post-test score 19, Unrelenting standards schema pre-test score 10, post-test score 8, Approval seeking pre-test score 16, post-test score 12.

For participant 5, Emotional Deprivation schema pre-test score was 20, post-test score 12, Social isolation/insecurity schema pre-test score was 25, post-test score 18, Defectiveness schema pre-test score was 6, post-test score 6, Emotional Inhibition schema pre-test score 23, post-test score 16, Dependence pre-test score was 20, post-test score 18, Abandonment schema pre-test score was 9, post-test score 7, Vulnerability to harm schema pre-test score was 22, post-test score 13, Failure schema pre-test score 8, post-test score 8, Negativism schema pre-test score 12, post-test score 6, Entitlement /Insufficient Self-control schema pre-test score 27, post-test score 22, Self-Sacrifice schema pre-test score 7, post-test score 6, Punitiveness schema pre-test score 13, post-test score 12, Unrelenting standards schema pre-test score 10, post-test score 7, Approval seeking pre-test score 20, post-test score 16.

### Findings Related to Participants' Somatization Scale Scores

When the findings related to the Table 2 are examined, the somatization scale pre-test score of

participant 1 was 27 and the post-test score was 9. Participant 2's somatization scale pre-test score was 22 and post-test score was 7. Participant 3's somatization scale pre-test score was 29 and post-test score was 9. Participant 4's somatization scale pre-test score was 25 and post-test score was 7. Participant 5's somatization scale pre-test score was 26 and post-test score was 8.

## DISCUSSION

In this study, the effects of EMDR Therapy on early maladaptive schemas and somatic symptoms were examined, and EMDR was applied to five volunteer participants. When the levels of early maladaptive schemas were evaluated in the five cases, decreases were observed after EMDR therapy compared to pre-treatment levels. These results suggest potential benefits of EMDR therapy in reducing early maladaptive schemas, consistent with previous research. When psychosomatic symptoms were evaluated, reductions were observed in all five participants after EMDR therapy, indicating a potential association with improvements in psychosomatic symptoms.

### Discussion of the Effect of EMDR Therapy on Somatic Symptoms

Evaluation of Somatization Scale scores after EMDR therapy showed decreases in all five participants. Konuk *et al.* [14] suggested that EMDR therapy may be beneficial for chronic pain, applying it to 11 participants and reporting reductions in the duration and frequency of medically unexplained headaches. Similarly, Tesarz *et al.* [9] reported that although chronic pain is often defined as physical complaints, it may have psychological origins, and EMDR therapy may reduce these psychological symptoms. These findings suggest a potential association between EMDR therapy and alleviation of psychosomatic symptoms.

### Discussion of the Effect of EMDR Therapy on Early Maladaptive Schemas

Decreases in early maladaptive schemas were observed in all five participants after EMDR therapy,

including social isolation/insecurity, resilience, suppression of emotions, self-sacrifice, entitlement/insufficient self-control, punitiveness, emotional deprivation, unrelenting standards, and approval seeking. Specifically, Participant 1 showed reductions in defectiveness, resilience, emotional deprivation, suppression of emotions, entitlement/insufficient self-control, social isolation/insecurity, and unrelenting standards. Participant 2 had decreases in social isolation/insecurity, self-sacrifice, emotional deprivation, failure, unrelenting standards, approval seeking, and suppression of emotions. Participant 3 showed declines in suppression of emotions, pessimism, abandonment, social isolation/insecurity, approval seeking, and punitiveness. Participant 4 exhibited reductions in suppression of emotions, social isolation/insecurity, entitlement/insufficient self-control, punitiveness, and emotional deprivation. Participant 5 experienced decreases in emotional deprivation, social isolation/insecurity, suppression of emotions, resilience, entitlement/insufficient self-control, and approval seeking. Lehnung [2] explains that early maladaptive schemas arise from memories, cognitions, emotions, and bodily sensations; EMDR therapy targets these through processing intrusive thoughts under the adaptive information processing model. These results are consistent with previous studies linking maladaptive schemas to psychosomatic symptoms and suggest a potential association between EMDR therapy and reductions in maladaptive schemas related to psychosomatic symptoms [15].

### Practical Recommendations for Clinicians

- (1) Consider incorporating EMDR therapy when working with clients exhibiting early maladaptive schemas.
- (2) Monitor both psychological and somatic symptoms to assess therapy effectiveness.
- (3) Tailor EMDR sessions to individual client needs to enhance engagement and adherence.

## CONCLUSION

This study is important as it directly investigates the effect of EMDR therapy on early maladaptive

schemas, a topic with limited prior research. The results align with existing literature, showing that EMDR therapy effectively reduces early maladaptive schemas and physical symptoms. Suggestions based on the findings:

1. More research is needed on the relationship between EMDR therapy and early maladaptive schemas.
2. Future studies should include larger samples to improve generalizability.
3. Investigating EMDR's effectiveness across various psychological disorders through case studies would benefit both research and clinical practice.

#### *Ethics Approval and Consent to Participate*

This study was approved by the İstanbul Aydın University Social and Human Sciences Ethics Committee (Decision No: 2023/10; date: 21.12.2023). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. All participants provided written informed consent prior to participation. Participants were debriefed at the end of the sessions.

#### *Data Availability*

All data, analysis code, and research materials are available at [<https://osf.io/sq7b9/>]

#### *Authors' Contribution*

Study Conception: EFB; Study Design: KG; Supervision: EFB; Funding: KG; Materials: KG; Data Collection and/or Processing: KG; Statistical Analysis and/or Data Interpretation: EFB; Literature Review: EFB; Manuscript Preparation: KG; and Critical Review: KG.

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The author(s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author(s) in accordance with scientific research methods and academic ethical principles.

#### *Editor's Note*

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## REFERENCES

1. Young JE. Cognitive Therapy for Personality Disorders: A Schema-Focused Approach (Practitioner's Resource Series). 3rd ed., Sarasota, FL: Professional Resource Exchange; 1999.
2. Lehnung, M. Treating Belief Systems with EMDR Therapy. In: Hofmann A, Ostacoli L, Lehnung M, Hase M, Lubert M. Editors. Treating Depression with EMDR Therapy: Techniques and Interventions, 1st ed., Springer Publishing. 2022: pp. 109-120.
3. Shapiro F. Eye movement desensitization and reprocessing: Basic principles, protocols, and procedures. 3rd ed. New York: Guilford Press; 2018.
4. Amano T, Toichi M. The Role of Alternating Bilateral Stimulation in Establishing Positive Cognition in EMDR Therapy: A Multi-Channel Near-Infrared Spectroscopy Study. PLoS One. 2016;11(10):e0162735. doi: 10.1371/journal.pone.0162735.
5. Mares L. Unconscious processes in psychoanalysis, CBT, and schema therapy. J Psychother Integr. 2022;32(4):443-455. doi: 10.1037/int0000276
6. Rafaeli E, Bernstein DP, Young JE. Schema Therapy: Distinctive Features. 1st ed. London: Routledge; 2010.
7. Young JE, Klosko JS, Weishaar ME. Schema Therapy: A Practitioner's Guide. New York: Guilford Press; 2006.
8. Van Rood YR, De Roos C. EMDR in the treatment of medically unexplained symptoms: a systematic review. J EMDR Pract Res. 2009;3(4):248-263. doi: 10.1891/1933-3196.3.4.248.
9. Tesarz J, Wicking M, Bernardy K, Seidler GH. EMDR therapy's efficacy in the treatment of pain. J EMDR Pract Res. 2019;13(4):337-344. doi: 10.1891/1933-3196.13.4.337.

10. Dozois DJA, Rnic K. Core beliefs and self-schematic structure in depression. *Curr Opin Psychol.* 2015;4:98-103. doi: 10.1016/j.copsyc.2014.12.008.
11. Şata M. Nicel araştırma yaklaşımları. In: Oğuz E, editör. *Eğitimde araştırma yöntemleri.* Ankara: Eğiten Kitap Yayınları; 2020. p. 77-90.
12. Büyüköztürk Ş. *Deneysel Desenler: Öntest-Sontest Kontrol Grubu Desen ve Veri Analizi [Experimental Designs: Pretest-Posttest Control Group Design and Data Analysis]*, 11th ed.. Ankara: Pegem Akademi Yayıncılık; 2025. [Book in Turkish]
13. Soygüt G, Karaosmanoğlu A, Cakir Z. *Erken Dönem Uyumsuz Semaların Değerlendirilmesi: Young Sema Ölçeği Kısa Form-3'ün Psikometrik Özelliklerine İlişkin Bir İnceleme [Assessment of early maladaptive schemas: a psychometric study of the Turkish young schema questionnaire-short form-3].* *Türk Psikiyatri Derg.* 2009;20(1):75-84. [Article in Turkish].
14. Konuk E, Epözdemir H, Atçeken ŞH, Aydın YE, Yurtsever A. EMDR Treatment of Migraine. *J EMDR Pract Res.* 2011;5(4):166-176. doi: 10.1891/1933-3196.5.4.166.
15. Henker J, Keller A, Reiss N, Siepmann M, Croy I, Weidner K. Early maladaptive schemas in patients with somatoform disorders and somatization. *Clin Psychol Psychother.* 2019;26(4):418-429. doi: 10.1002/cpp.2343.

# The Predictability of Anatomical Self-Efficacy Perception Levels of Associate Degree Students in Academic Performance

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## Abstract:

**Objective:** Anatomy education is a fundamental component of health education and professional competence. Anatomical self-efficacy is defined as the belief in one's ability to successfully complete anatomy instruction. This study aimed to examine the difference in anatomical self-efficacy perception score over a semester and assess its impact on predicting the academic performance of associate degree students enrolled in gross anatomy courses.

**Methods:** The demographic data of the students were collected. The “Self-efficacy Perception Scale for the Human Anatomy Course” was administered twice before the mid-term and final exams during the semester. As an academic performance, the mid-term and final exam grades were retrieved from the e-campus information system. Differences in exam grades and anatomical self-efficacy perception were analyzed using a t-test, while the effect of anatomical self-efficacy perception on exam grades was assessed through simple linear regression analysis.

**Results:** The mid-term ( $P<0.001$ ) and final exam grades ( $P<0.001$ ), and anatomical self-efficacy perception increased significantly ( $P<0.001$ ). A simple linear regression analysis showed that both midterm ( $P<0.001$ ) and final exam grades ( $P<0.001$ ) were predicted by anatomical self-efficacy perception, suggesting that higher self-efficacy perception is associated with better academic performance.

**Conclusion:** To enhance academic performance, lecturers should organize training activities designed to increase anatomical self-efficacy.

**Keywords:** Academic Performance, Anatomy Education, Associate Degree, Exam Grade, Self-Efficacy

The main goal of university departments dedicated to health sciences education is to promote and enhance the overall health of populations[1]. In this context, anatomy education constitutes one of the fundamental subjects within departments dedicated to health sciences education, serving as a foundational component for the

development of professional competencies across all domains of health sciences. It is essential for associate degree students in healthcare-related fields to receive comprehensive anatomy education and to be capable of applying this knowledge in practice through the development of professional skills and competencies.

According to Bandura's social cognitive theory,

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self-efficacy - defined as the confidence to perform the actions necessary to achieve desired goals - plays a crucial role in influencing performance outcomes through its dynamic interaction with environmental and behavioral determinants [2, 3]. Furthermore, self-efficacy is defined as an individual's belief in their ability to succeed at a task and has been demonstrated to influence students' motivation and academic behavior. Anatomical self-efficacy refers to an individual's belief in their ability to perform tasks successfully related to the anatomy curriculum, which encompasses both the learning of anatomical concepts and the application of anatomical knowledge in clinical contexts [4].

Studies assessing anatomical self-efficacy perception, particularly through the description or comparison of self-efficacy perception levels across various health fields, have the potential to enhance our understanding of students' course selections, measure their level of effort concerning the course, and inform instructional practices [5-7]. Additionally, health lecturers are becoming increasingly interested in their students' course motivation. In particular, there is a growing interest in how students' self-efficacy perception relates to learning and development during education, and how this can be promoted [3, 7-9].

In addition to descriptive studies that focus on the concept of anatomical self-efficacy perception, investigations are examining the relationship between anatomical self-efficacy perception and various factors such as students' place of residence [5], test anxiety, and willingness to choose a field of study [6]. However, there is a notable scarcity of research that explores the predictability of anatomical self-efficacy perception related to academic performance [4]. Specifically, to the best of our knowledge, no studies have assessed the anatomical self-efficacy perception of associate degree students in health-related fields or examined its relationship with academic performance.

This study aims to examine the differences in anatomical self-efficacy perception and academic performance among associate degree students in healthcare-related fields over a semester and assess the predictability of their anatomical self-efficacy perception on their academic performance. The study hypothesizes that: (1) students' anatomical self-efficacy perceptions increase from the middle to the end of the semester, and (2) perceptions of anatomical

self-efficacy predict health students' academic performance in anatomy exams.

## METHODS

Ethical approval for the study was obtained from the Afyonkarahisar Health Sciences University Clinical Research Ethics Committee (approval number 2023/11). The principles of the Declaration of Helsinki were followed throughout the research. Before the study, all participants were comprehensively informed about the research, and written informed consent was obtained from each individual.

### Participants

The pre-test-post-test quasi-experimental study was conducted at Afyonkarahisar Health Sciences University. Participants were included in the study through the convenience sampling method. The study population comprised students aged 18 to 25 enrolled in the Oral and Dental Health, Patient Care, Elderly Care, Physiotherapy, Dialysis, Electroneurophysiology (ENF), First Aid and Emergency, Prosthetics and Orthotics, Medical Laboratory Techniques, and Medical Imaging Techniques programs at the Atatürk Health Services Vocational School, who were taking the Gross Anatomy course in 2024. No incentives were provided for participation in the study. The inclusion criteria were as follows: enrollment in the Gross Anatomy course, no prior participation in any anatomy course (whether in high school or at the same or another university), and aged between 18 and 25 years.

### Data Collection Tools

Data were collected on two occasions (before the mid-term and final exams) within the period from November 2023 to January 2024, in the classroom under the supervision of the researchers, using a self-report survey. Between the two survey assessments, students were instructed in the Gross Anatomy course. The Gross Anatomy course encompasses basic anatomical knowledge for each program and is delivered through theoretical instruction over 14 weeks, with 2 hours of instruction per week.

The demographic data of the students, including age, gender, student matriculation number, program of study, and whether they had previously completed an

anatomy course, were collected. Participants completed the "Self-Efficacy Perception Scale for the Human Anatomy Course" to assess their anatomical self-efficacy perceptions. [10, 11]. The survey was administered twice: once before the mid-term exam and again before the final exam.

As part of the anatomy course, students were assessed through mid-term and final exams consisting of multiple-choice questions. The mid-term and final exam grades of the participants were used as indicators of academic performance. The mid-term and final exam grades for each student were retrieved from the e-campus information system.

Bahçeci [10] developed the "Self-Efficacy Perception Scale for the Human Anatomy Course," which consists of 26 questions, each featuring items rated on a five-point Likert-type scale. The valid and reliable scale assessed participants' commitment to the anatomy course, positive and negative behaviors related to the course, preconceptions about the anatomy course, and beliefs regarding the necessity of the anatomy course. The scale consists of 3 sub-dimensions (the Cronbach's alpha is 0.75). The sub-dimensions are as follows: sub-dimension 1 reveals the feeling of confidence in the knowledge of anatomy; sub-dimension 2, the awareness of practical skills in anatomy; and sub-dimension 3, the ability to transform theoretical knowledge in anatomy into real-life skills. The scale allows for a score ranging from 26 to 160 [10].

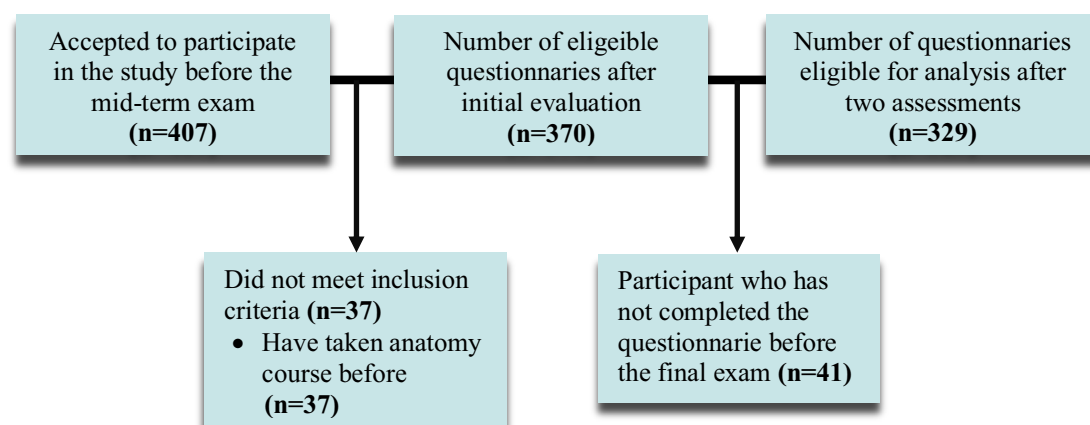
### Statistical Analysis

The IBM SPSS Statistics 26.0 software was

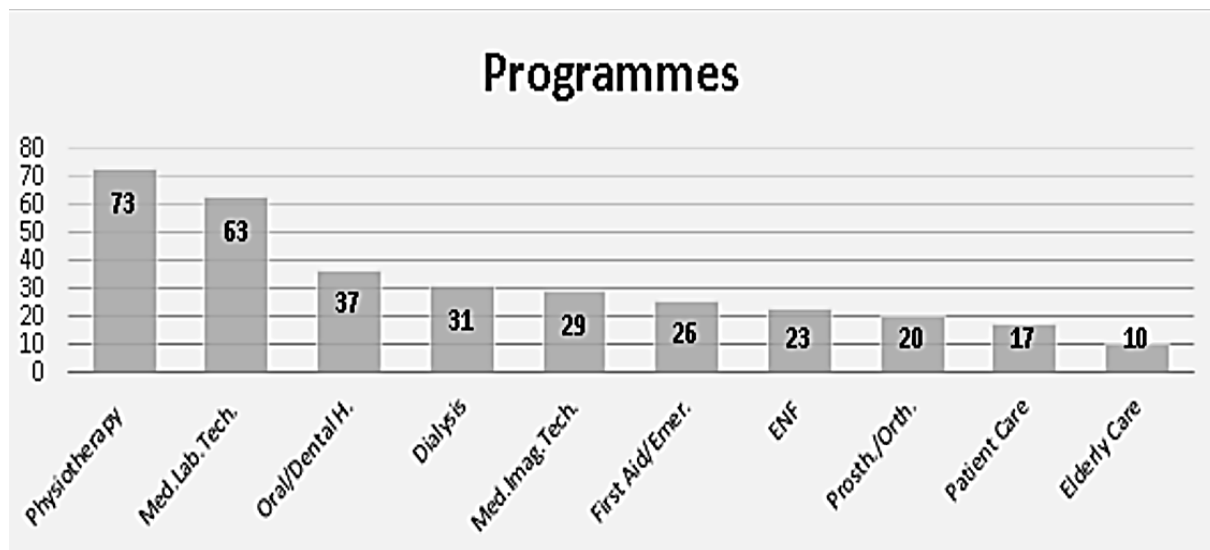
employed for the data analysis. The suitability of the variables for normal distribution was considered through the skewness and kurtosis values. Skewness and kurtosis values between +2 and -2 suggested that the variables conform to a normal distribution [12]. Descriptive statistics, which were illustrated in tables and graphs, were reported for continuous variables as means and standard deviations, while categorical data were reported as frequency counts and percentage distributions. The differences between sub-dimension and total scores of the Self-Efficacy Perception Scale for the Human Anatomy Course, and the differences between mid-term and final grades were analyzed using a dependent samples t-test. The predictability of the independent variable, anatomical self-efficacy perception, on the dependent variable, exam grade, was assessed using simple linear regression analysis. Autocorrelation was evaluated using the Durbin-Watson statistic (ranging from 1.5 to 2.5), and no autocorrelation was detected during the regression analyses. During the regression analysis assessing the predictive validity of self-efficacy before the final exam on final grades, three outlier data points were removed from the analysis, and the regression analysis was subsequently completed. No outliers were detected in the other variables. In all analyses, a  $P < 0.05$  was considered statistically significant. [13].

### RESULTS

A total of 588 students were invited to participate in the study, and 407 students consented to participate.



**FIGURE 1.** Flow chart of the study.



**FIGURE 2.** The number of students participating in the study from each program.

Thirty-seven students were excluded from the analysis because they had previously completed anatomy courses. Additionally, 41 students were excluded from the study because they did not complete the second survey administered before the final exam. Thus, data from 329 participants, aged 19.05±1.19 years (female, n=257, 78%), were analyzed, resulting in a relative response rate of 80.84% and an absolute response rate of 55.95% (Figure 1).

The majority of participants were students in the physiotherapy program (n=73, 22.2%) (Figure 2).

Before the mid-term exam, the total score, the sub-

dimension 1 score, the sub-dimension 2 score, and the sub-dimension 3 score of the Self-Efficacy Perception Scale for the Human Anatomy Course were 79.58±13.45, 35.47±6.21, 21.24±4.49, and 22.87±4.62, respectively. Before the final exam, the total score, the sub-dimension 1 score, the sub-dimension 2 score, and the sub-dimension 3 score of the Self-Efficacy Perception Scale for the Human Anatomy Course were 82.47±14.41, 36.51±6.34, 21.83±4.79, and 24.12±5.80, respectively. There were significant differences between the total score (P<0.001), the sub-dimension 1 score (P=0.03), the sub-dimension 2 score

**TABLE 1.** The Mean Scores of the Sub-Dimensions and the Total Scores of the Self-Efficacy Perception Scale for the Human Anatomy Course and the Mean of the Mid-Term and Final Exam Grades

Self-efficacy perception scale for the human anatomy course	Before mid-term exam (mean±SD)	Before final exam (mean±SD)	Paired differences Δ mean±SD	P-value
Sub-dimension 1	35.47±6.21	36.51±6.34	-1.05±6.32	<b>0.003</b>
Sub-dimension 2	21.24±4.49	21.83±4.79	-.59±4.17	<b>0.011</b>
Sub-dimension 3	22.87±4.62	24.12±5.80	-1.26±5.79	<b>&lt;0.001</b>
Total score	79.58±13.45	82.47±14.41	-2.89±12.48	<b>&lt;0.001</b>
Exam grade	<b>Mid-term</b>	<b>Final</b>	<b>Paired differences Δ mean±SD</b>	<b>P-value</b>
	57.85±15.54	75.96±16.35	-18.11±18.63	<b>&lt;0.001</b>

SD, standart deviation. Statistically significant P-values are shown in bold.

**TABLE 2.** The Effect of Anatomical Self-Efficacy Perception Before the Midterm Exam on the Midterm Exam Grade in the Anatomy Course

Independent variable	Unstandardized coefficients		Standardized coefficients	t	P-value	95% Confidence interval
	B	SE	$\beta$			
(Constant)	44.647	5.102		8.750	<b>&lt;0.001</b>	34.610-54.685
Self-efficacy perception for anatomy course	0.166	0.063	0.144	2.624	<b>0.009</b>	0.042-0.290

B, unstandardized beta coefficient;  $\beta$ , standardized beta coefficient; SE, standard error. Statistically significant P-values are shown in bold.

**Summary of the Model (Analysis):** F=6.884; P=0.009; R=0.144; R<sup>2</sup>=0.021; SEE=15.400; Durbin-Watson=1.707.

(P=0.011), and the sub-dimension 3 score (P<0.001) of the scale before the mid-term and final exams, with the scores before the final exam being significantly higher. The mid-term exam and final exam grades were 57.85±15.54 and 75.96±16.35, respectively. A significant difference was determined between the mid-term exam grades and the final exam grades (P<0.001) (Table 1).

The predictability of participants' anatomical self-efficacy perceptions before the mid-term exam on their mid-term exam grades is presented in Table 2. It was found that anatomical self-efficacy perceptions before the mid-term exam were predictive of the mid-term exam grades (F=6.884, P=0.009). The anatomical self-efficacy perceptions accounted for 2.1% of the variance in the final exam grades. A one-unit increase in anatomical self-efficacy perception was associated with an increase of 0.166 points in the mid-term exam grade (P=0.009).

The predictability of participants' anatomical self-efficacy perceptions before the final exam on their

final exam grades is shown in Table 3. The anatomical self-efficacy perceptions before the final exam were predictive of the final exam grades (F=9.713, P=0.002). The anatomical self-efficacy perceptions accounted for 2.9% of the variance in the final exam grades. A one-unit increase in anatomical self-efficacy perception was associated with an increase of 0.179 points in the final exam grade (P=0.002).

## DISCUSSION

This study aimed to investigate the differences in anatomical self-efficacy perceptions of associate degree students throughout the semester, as well as the extent to which these anatomical self-efficacy perceptions predicted their academic performance. As a measure of academic performance, the study also aimed to highlight the differences between mid-term and final exams. The results indicate that both the general anatomical self-efficacy perceptions and exam

**TABLE 3.** The Effect of Anatomical Self-Efficacy Perception Before the Final Exam on the Final Exam Grade in the Anatomy Course

Independent variable	Unstandardized coefficients		Standardized coefficients	t	P-value	95% Confidence interval
	B	SE	$\beta$			
(Constant)	61.814	4.805		12.866	<b>&lt;0.001</b>	52.362- 71.266
Self-efficacy perception for anatomy course	0.179	0.057	0.171	3.117	<b>0.002</b>	0.066-0.292

B, unstandardized beta coefficient;  $\beta$ , standardized beta coefficient; SE, standard error. Statistically significant P-values are shown in bold.

**Summary of the Model (Analysis):** F= 9.713; P=0.002; R=0.171; R<sup>2</sup>=0.029; SEE= 14.932; Durbin-Watson=1.515.

grades increased following 14 weeks of gross anatomy course. Consequently, higher anatomical self-efficacy perceptions were found to be a significant predictor of exam grades.

Similar to the present study, a few studies have examined the differences in self-efficacy perceptions throughout the semester concerning anatomy or other courses, but they have yielded different conclusions. Langfield *et al.* reported in their study, conducted in occupational therapy and physiotherapy programs, that the use of online videos had no significant impact on the anatomical self-efficacy perceptions. However, academic performance and anatomical self-efficacy perceptions were improved in a specific subgroup, although this effect was not observed in the entire cohort [14]. Vandenbossche *et al.* examined the extent to which improving anatomical knowledge with echocardiography and videos influences the self-efficacy perceptions of medical students compared to traditional lecture-based teaching. Although a significant difference in self-efficacy perceptions was observed between the two groups in the middle of the intervention, no difference in self-efficacy perception scores was observed at the end of the intervention. They explained that the disappearance of this difference over time could be due to the excessive mental stress in the intervention group [9]. Previous studies have identified numerous factors that can influence self-efficacy in specific domains [4, 15, 16]. Although many factors influence self-efficacy, the observed increase in anatomical self-efficacy perceptions and exam grades in this study suggests that participants completed the anatomy courses.

There are studies that demonstrate a positive relationship between self-efficacy and academic performance [8, 17, 18]. Since self-efficacy is recognized to be domain-specific [17], numerous studies have been published on anatomical self-efficacy perceptions and beliefs in various health disciplines. However, the number of studies investigating the relationship between anatomical self-efficacy perceptions and academic performance is limited. In a study conducted by Burgoon *et al.* with medical students similar to the present study, it was found that anatomical self-efficacy predicted exam grades by 5-14% in four different exams during the semester [4]. This indicates that higher anatomical

self-efficacy perception is associated with better academic performance. The finding of a higher prediction percentage than in our study can be attributed to differences in curriculum and examination types across programs. Theoretical and practical hours, curriculum intensity, and other factors for undergraduate students (e.g., medical, dental, and physical therapy students) are fundamentally different from those of associate degree students in healthcare-related programs [6, 19, 20]. The present study may provide a unique perspective on the anatomical self-efficacy perceptions by associate degree students.

In contrast to this study, Reynolds *et al.* [21] found that only cognitive self-efficacy predicted academic performance in the anatomy course by 7% in doctor of physical therapy (DPT) students. They reported that psychomotor and clinical self-efficacy in anatomy and general self-efficacy were not independent predictors [21]. In other studies examining self-efficacy and academic performance in different academic skills, the importance of self-efficacy in predicting academic performance was found to vary [22, 23]. This study revealed that anatomical self-efficacy perception was a predictive factor in academic performance. While self-efficacy is a significant factor in academic performance, it is vital to recognize that it alone is insufficient to guarantee passing an exam, as other factors may also play a crucial role. The variations in results between studies may be attributed to differences in study design, program and curriculum, as well as the methods used to measure academic performance.

### Strengths and Limitations

While numerous studies have examined anatomical self-efficacy perceptions in health undergraduate education [4, 7, 9, 14, 19], the present study specifically focused on anatomical self-efficacy perceptions and their predictive value in academic performance within healthcare-related associate degree programs. These associate degree programs prepare technician candidates who play a crucial role in healthcare; consequently, this study provides a unique perspective to the literature.

One limitation of the study was that confounding factors could not be determined. Specifically, one potential confounding factor is the possibility that

participants studied more intensively towards the end of the semester due to anxiety about failing the course, which could have affected the results. This increased study effort could have increased their anatomical self-efficacy and subsequently their exam performance.

Additionally, the influence of other courses in the curriculum on their knowledge of anatomy cannot be overlooked; students might have received varying levels of support or instruction in related subjects, which could impact their overall understanding and performance in anatomy specifically. It is also important to consider that individual differences among students, such as prior knowledge of anatomy, study habits, and test-taking strategies, could further complicate the relationship between self-efficacy and academic performance.

Moreover, methodological limitations, including the use of non-randomized sampling and the fact that the study was conducted at a single center, should be acknowledged. This limits the generalizability of the findings, as results may vary in different educational contexts or among diverse student populations. Future research should aim to address these limitations by employing randomized sampling and multi-center studies to gain a more comprehensive understanding of the factors influencing anatomical self-efficacy and academic performance.

## CONCLUSION

In conclusion, this study highlights that anatomical self-efficacy perception is a significant predictor of academic performance. This study also concluded that there was an increase in associate students' knowledge of anatomy and academic performance over the semester. To enhance anatomical self-efficacy and, consequently, the academic performance of students, it is recommended that lecturers regularly evaluate their students' anatomical self-efficacy, increase the number of course hours, and employ diverse teaching strategies that can boost self-efficacy. Students with high self-efficacy perceptions are likely to achieve greater success not only in their courses but also in their professional careers. In light of these findings, future studies could focus on randomized experimental studies that integrate diverse teaching

techniques that could possibly promote anatomical self-efficacy.

### *Ethics Approval and Consent to Participate*

This study was approved by the Afyonkarahisar Health Sciences University Clinical Research Ethics Committee (Decision No: 2023/11; date: 03.11.2023). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Written informed consent was obtained from all individual participants included in the study.

### *Data Availability*

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

### *Authors' Contribution*

Study Conception: EH; Study Design: EH, GM; Supervision: EH; Funding: EH; Materials: EH, GM; Data Collection and/or Processing: EH, GM; Statistical Analysis and/or Data Interpretation: EH; Literature Review: EH; Manuscript Preparation: EH; and Critical Review: EH, GM.

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The author(s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author(s)

in accordance with scientific research methods and academic ethical principles.

### Editor's Note

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## REFERENCES

- Roddie IC. The Edinburgh Declaration. *Lancet*. 1988;2(8616):908. doi: 10.1016/s0140-6736(88)92507-x.
- Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev*. 1977;84(2):191-215. doi: 10.1037//0033-295x.84.2.191.
- Klassen RM, Klassen JRL. Self-efficacy beliefs of medical students: a critical review. *Perspect Med Educ*. 2018;7(2):76-82. doi: 10.1007/s40037-018-0411-3.
- Burgoon JM, Meece JL, Granger NA. Self-efficacy's influence on student academic achievement in the medical anatomy curriculum. *Anat Sci Educ*. 2012;5(5):249-255. doi: 10.1002/ase.1283.
- Taşdemir R, Sivri İ, Güzelordu D, et al. Determination of nursing students' self-efficacy belief levels in anatomy lectures. *SHS Web Conf*. 2016;31:01006. doi: 10.1051/shsconf/20163101006.
- Yildiz E, Colak T. The Effect of the Self-Efficiency Levels of University Students in Health Departments for the Anatomy Course on Exam Anxiety. *Gevher Nesibe Journal of Medical and Health Sciences*. 2022;7(21):81-90. doi: 10.5281/zenodo.7389087.
- HadaviBavili P, İlçioğlu K. Artwork in anatomy education: A way to improve undergraduate students' self-efficacy and attitude. *Anat Sci Educ*. 2024;17(1):66-76. doi: 10.1002/ase.2352.
- Zheng B, Chang C, Lin CH, Zhang Y. Self-Efficacy, Academic Motivation, and Self-Regulation: How Do They Predict Academic Achievement for Medical Students? *Med Sci Educ*. 2020;31(1):125-130. doi: 10.1007/s40670-020-01143-4.
- Vandenbossche V, Valcke M, Audenaert E, Willaert W. Anatomical knowledge enhancement through echocardiography and videos, with a spotlight on cognitive load, self-efficacy, and motivation. *Anat Sci Educ*. 2024;17(4):806-817. doi: 10.1002/ase.2398.
- Bahçeci D. Anatomî dersinde portfolyo kullanmanın öğrencilerin bilişsel ve duyuşsal özellikleri üzerine etkisi [The effect of using portfolios in anatomy class on students' cognitive and affective characteristics]. PhD thesis. Gazi Üniversitesi Eğitim Bilimleri Enstitüsü-Orta Öğretim Fen ve Matematik Alanlar Eğitimi, Ankara, 2006. [Article in Turkish]
- Bahçeci D, Kuru M. Portfolyo Değerlendirmenin Üniversite Öğrencilerinin Öz-Yeterlik Algısı ve Yaşam Becerileri Üzerine Etkisi [The Effect of Portfolio Assessment on University Students' Self Efficacy and Life Skills]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*. 2008;9(1):97-111. [Article in Turkish].
- George D, Mallery P. *IBM SPSS statistics 26 step by step: A simple guide and reference*. 18th Ed. New York, NY: Routledge; 2024.
- Field A. *Discovering statistics using IBM SPSS statistics*. 6th Ed. London: Sage; 2013.
- Langfield T, Colthorpe K, Ainscough L. Online instructional anatomy videos: Student usage, self-efficacy, and performance in upper limb regional anatomy assessment. *Anat Sci Educ*. 2018;11(5):461-470. doi: 10.1002/ase.1756.
- Cavallo AML, Potter WH, Rozman M. Gender Differences in Learning Constructs, Shifts in Learning Constructs, and Their Relationship to Course Achievement in a Structured Inquiry, Yearlong College Physics Course for Life Science Majors. *Sch. Sci. Math*. 2004;104(6): 288-300. doi: 10.1111/j.1949-8594.2004.tb18000.x.
- Zimmerman BJ. Self-Efficacy: An Essential Motive to Learn. *Contemp Educ Psychol*. 2000 Jan;25(1):82-91. doi: 10.1006/ceps.1999.1016.
- Stankov L, Lee J. Quest for the best non-cognitive predictor of academic achievement. *Educ. Psychol*. 2014;34(1):1-8. doi: 10.1080/01443410.2013.858908.
- Honicke T, Broadbent J. The influence of academic self-efficacy on academic performance: A systematic review. *Educ Res Rev*. 2016;17:63-84. doi: 10.1016/j.edurev.2015.11.002.
- Acar D, Colak T, Colak S, et al. The Comparison of Self-Efficacy Belief Levels on Anatomy Education between the Undergraduate Students from Physical Therapy and Rehabilitation Department and the Associate Students from Vocational School of Health Services in Western Black Sea Region. *J Educ Learn*. 2017;6(3):151-156. doi: 10.5539/jel.v6n3p151.
- Ferriby A, Schaefer AF. The Relationship Between Anatomical Self-efficacy and Feelings of Burnout in First-year Medical Students. *Med Sci Educ*. 2022;32(2):437-446. doi: 10.1007/s40670-022-01511-2.
- Reynolds K, Mueller S, Horn M. Predicting performance in a doctor of physical therapy gross anatomy course based on an exploratory factor analysis of the anatomical self-efficacy instrument. *Anat Sci Educ*. 2025;18(8):815-824. doi: 10.1002/ase.2488.
- Stegers-Jager KM, Cohen-Schotanus J, Themmen AP. Motivation, learning strategies, participation and medical school performance. *Med Educ*. 2012;46(7):678-688. doi: 10.1111/j.1365-2923.2012.04284.x.
- Pajares F. Self-efficacy beliefs, motivation, and achievement in writing: A review of the literature. *Read Writ Q*. 2003;19(2):139-158. doi: 10.1080/10573560308222.

# Examining the Food and Nutrition Literacy Levels of Middle School-Aged Children

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## Abstract:

**Objective:** This cross-sectional study was conducted to examine the food and nutrition literacy levels of middle school children.

**Methods:** Data required for the study were collected online between January 22, 2025, and April 20, 2025. The study group consisted of middle school-aged children. Data were collected using an online survey method using the Socio-Demographic Data Collection Form and the Food and Nutrition Literacy Scale for Children (FNLSC) from 374 middle school-aged children who volunteered for parental consent and were selected using a non-probability sampling method. The statistical analysis of the data obtained in the study was carried out using SPSS 27.0 data analysis software, which employed the following methods: T-test, Oneway Anova, and Kolmogorov-Smirnov test.

**Results:** Of the middle school students participating in the study, 60.2% (n=225) were males and 39.8% (n=149) were female students, with a higher proportion of male students participating. The reliability coefficient of the food and nutrition literacy scale for children was found to be 0.55, while the harmful consumption subscale was 0.45, the packaging reading subscale was 0.50, the beneficial consumption subscale was 0.45, and the interaction subscale was 0.50. In examining food and nutrition literacy levels, significant differences were found within the subscale based on age, gender, grade, family, and nutritional status, but these differences were not statistically significant ( $P>0.05$ ).

**Conclusion:** In the study examining the food and nutrition literacy levels of middle school children, no differences were found based on some variables. It is recommended that research be conducted to examine children's food and nutrition literacy levels by considering different factors.

**Keywords:** Middle School Child, Food, Nutrition, Literacy, Review

Food literacy is often referred to as "food literacy" in English, while nutrition literacy is referred to as "nutrition literacy." While these two concepts are closely related, they have different focuses. Food literacy is defined as a framework that enables people to maintain the quality of their diets under changing conditions and build nutritional resilience over time, and is considered a multifaceted

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concept [1, 2]. Nutrition literacy, on the other hand, is defined as the ability to acquire, process, and interpret nutrition-related information and skills, as well as the ability to make informed nutritional decisions. It is a process that involves making informed nutritional decisions based on this information.

Nutrition literacy, in particular, enables the understanding and application of nutrients and dietary guidelines, thereby enabling healthy eating decisions. Therefore, nutrition literacy focuses on the understanding and use of nutrition information [3]. Because food and nutrition literacy focuses on the interaction of behaviors, knowledge, and skills, it is an important factor in helping people make healthy eating choices [1, 2]. In this context, improving food and nutrition literacy, especially in children and adolescents, is of great public health importance. Obesity rates are increasing globally, and data from the World Health Organization indicate that more than 390 million children and adolescents aged 5-19 were overweight in the World by 2022. The prevalence of overweight among children and adolescents in this age range increased from 8% in 1990 to 20% in 2022 [4]. In 1990, 2% of children and adolescents aged 5-19 were obese, while by 2022, 8% of children and adolescents were living with obesity. Childhood obesity rates in Türkiye are following global trends and are steadily increasing [4, 5].

Obesity not only leads to excess weight but also paves the way for chronic diseases such as diabetes, heart disease, and hypertension [4, 6]. This situation highlights the need for urgent measures to prevent and control childhood obesity. Therefore, food and nutrition literacy can be an important tool in providing children with food and nutrition literacy skills, supporting their food-related competencies, and encouraging lifelong good eating habits. Individuals who are food and nutrition literate can make healthy food choices and prepare and consume foods correctly. These choices can help reduce the risk of obesity and other related chronic diseases. Focusing on food and nutrition literacy during the elementary and middle school years is important because this is when children begin to acquire important food-related behaviors and skills, including simple meal preparation and making food choices [7, 8].

This cross-sectional study was conducted to

examine the food and nutrition literacy levels of middle school-aged children.

Research Question: Is there a relationship between food and nutrition literacy levels among middle school children?

## METHODS

### Research Type

A cross-sectional study.

### Place and Time of the Study

Data were collected online between January 22, 2025, and April 20, 2025, using a questionnaire and scale form (Google Form) prepared for voluntary participation of middle school-aged children with parental consent.

### Research Population and Sample

The research population consisted of middle school-aged children. Data were collected from 374 middle school-aged children in Hakkari province who volunteered and obtained parental consent. Data were collected using a convenience sampling method, a non-probability sampling method. The study included middle school-aged children who had access to the internet. A survey was used as the data collection technique; the online survey form (Google Forms) was disseminated through social networks and social media to reach a wide audience. In this study, the sample size was determined based on the number of variables used in multivariate data analysis. Determining the sample size based on the number of variables is also a fundamental criterion for determining the suitability of the research data for analysis. Studies have indicated that to ensure the suitability of the data for analysis, it is necessary to reach at least 5 or even 10 times the number of participants compared to the number of variables [9, 10]. In this context, the sample for this study was selected from middle school-aged children living in Hakkari, Turkey, using a non-probability sampling method, specifically convenience sampling. The study was conducted with 374 children who met the participation criteria.

*Inclusion Criteria:* (1) Children participating in

the study must be middle school age; (2) Adolescents with parental consent; and (3). Those who completed the child consent form.

**Exclusion Criteria:** (1) Children not of middle school age; (2) Adolescents without parental consent; and (3) Those who did not complete the child consent form.

## Data Collection Tools

### Sociodemographic Data Collection Form

This form consists of five questions regarding age, gender, grade status, family status, and nutritional status.

### Food and Nutrition Literacy Scale for Children (FNLSC)

Developed by Taniş-Özçelik *et al.* [11] in 2024, the food and nutrition literacy scale for children consists of 26 items. As a result of exploratory factor analysis, a four-factor structure consisting of 15 items (harmful consumption, packaging reading, beneficial consumption, and interaction) was obtained, and the obtained structure was confirmed by confirmatory factor analysis ( $\chi^2/sd=1.729$ ; RMSEA=.040; SRMR=.043; CFI=.92; TLI=.90). In addition, the FNLSC was determined to have convergent and discriminant validity. Within the scope of the reliability studies of the measurement tool, Cronbach's Alpha ( $\alpha$ ) internal consistency and composite (CR) reliability coefficients were calculated, and the split-half technique was used. The obtained results revealed that the FNLSC produced reliable results.

### Research Variables:

**Independent Variables:** Age, gender, grade status, family status, nutritional status.

**Dependent Variables:** Food and nutrition literacy levels.

## Ethical Aspects of the Research

Permission was obtained via email from Taniş-Özçelik *et al.* [11] for the use of the Food and Nutrition Literacy Scale for Children (FNLSC). Permission for the research was obtained from the Cyprus Science University Ethics Committee (Decision no: 2025/01.002, Date: 21.01.2025). To avoid any ethical violations within the scope of the research, a consent form was obtained

from the middle school children and an informed consent form was obtained from their parents.

## Statistical Analysis

Normality distribution, t-test, and one-way ANOVA analyses were used in data analysis. Descriptive statistics are presented as frequencies and percentages for categorical variables, and as mean  $\pm$  standard deviation for continuous variables. First, the Skewness-Kurtosis value of the data was examined, and the Kolmogorov-Smirnov test was used to determine the data were normally distributed. Second, a t-test was applied to examine differences between groups, and finally, a one-way ANOVA analysis was conducted. Microsoft Excel 2021 was used for data organization and processing, and SPSS 27.0 was used for statistical analysis. A P-value  $<0.05$  was considered statistically significant.

## RESULTS

As shown in Table 1, of the 374 students who participated in the study, 60.2% (n=225) were males

**TABLE 1. Demographic Information of Participants**

		n	%
<b>Gender</b>	Female	149	39.8
	Male	225	60.2
<b>Age (years)</b>	11	89	23.8
	12	71	19.0
	13	98	26.2
	14	116	31.0
<b>Grade</b>	5	86	23.0
	6	78	20.9
	7	97	25.9
	8	113	30.2
<b>Family status</b>	Nuclear family	223	59.6
	Extended family	151	40.4
<b>Regular nutrition</b>	Yes	275	73.5
	No	99	26.5
<b>Total</b>		374	100.0

**TABLE 2. ANOVA Test Results Between Scale and Subscales According to Participants' Age Variable**

Scale and subscales	Age	n	Mean	SD	t	P-value
<b>Harmful consumption</b>	11 age	89	9.49	1.94	0.025	0.995
	12 age	71	9.42	2.12		
	13 age	98	9.44	2.15		
	14 age	116	9.42	1.94		
<b>Packaging reading</b>	11 age	89	6.30	1.46	1.169	0.321
	12 age	71	6.50	1.57		
	13 age	98	6.16	1.54		
	14 age	116	6.11	1.43		
<b>Beneficial consumption</b>	11 age	89	6.67	1.32	1.517	0.210
	12 age	71	6.85	1.26		
	13 age	98	6.58	1.29		
	14 age	116	6.92	1.25		
<b>Interaction</b>	11 age	89	8.68	1.70	0.570	0.635
	12 age	71	8.69	1.72		
	13 age	98	8.45	1.74		
	14 age	116	8.76	1.88		
<b>Total</b>	11 age	89	31.15	3.10	1.212	0.305
	12 age	71	31.47	3.00		
	13 age	98	30.65	2.69		
	14 age	116	31.22	3.02		

SD, Standard deviation.

and 39.8% (n=149) were females. Age distribution revealed that 31.0% (n=116) were 14 years old, 26.2% (n=98) were 13 years old, and 30.2% (n=113) were in 8th grade and 25.9% (n=97) were in 7th grade. In terms of family structure, 59.6% (n=223) of the participants lived in nuclear families and 40.4% (n=151) in extended families. When examining regular eating habits, 73.5% (n=275) of the students ate regularly, while 26.5% (n=99) had irregular eating habits.

Table 2 shows no differences among students in different age groups regarding the food and nutrition literacy scale and its subscales. In the harmful consumption subscale, the means of all age groups show very close values (11 years old: mean=9.49, 12 years old: mean=9.42, 13 years old: mean=9.44, 14 years old: mean=9.42), and there is no statistically significant difference between the groups (P=0.995). In the packaging reading subscale, the 12-year-old

group has the highest mean (6.50), but the difference between the age groups is not significant (P=0.321). In the beneficial consumption subscale, the mean (6.92) of the 14-year-old group is higher than the other age groups, but this difference is not statistically significant (P=0.210). In the interaction subscale, similar means are observed between the age groups (11 years old: mean=8.68, 12 years old: mean=8.69, 13 years old: mean=8.45, 14 years old: mean=8.76), and the difference between them is not significant (P=0.635). Although the 12-year-old group has the highest mean (31.47) in the total scale, the difference between the age groups is not statistically significant (P=0.305).

Table 3 shows the differences between male and female students in terms of the food and nutrition literacy scale and its scales. In the interaction subscale, the mean (8.75) of female students was higher than

**TABLE 3. T-Test Results Between Scale and Subscales According to the Gender Variable of Participants**

Scale and subscales	Gender	n	Mean	SD	t	P-value
<b>Harmful consumption</b>	Female	149	9.39	2.04	-0.443	0.763
	Male	225	9.48	2.02		
<b>Packaging reading</b>	Female	149	6.29	1.41	0.446	0.158
	Male	225	6.22	1.56		
<b>Beneficial consumption</b>	Female	149	6.78	1.23	0.201	0.671
	Male	225	6.75	1.33		
<b>Interaction</b>	Female	149	8.75	1.64	0.882	<b>0.048</b>
	Male	225	8.59	1.86		
<b>Total</b>	Female	149	31.21	2.85	0.537	0.921
	Male	225	31.04	3.04		

SD, Standard deviation. Statistically significant P-value is shown in bold.

that (8.59) of male students ( $P=0.048$ ) suggesting significant difference, but other subscales these differences were not statistically significant ( $P>0.05$ ).

Table 4 shows the differences between students at different grade levels in terms of the food and nutrition literacy scale and its subscales. In all subscales, the means across all grade levels were no statistically significant differences ( $P>0.05$ ). Table 5 presents the differences between students living in nuclear and extended families in terms of the food and nutrition literacy scale and its subscales. In the harmful consumption sub-dimension, the mean (9.48) of students living in nuclear families was found to be higher than those (9.39) living in extended families, and this difference did not reach statistically significant ( $P=0.05$ ). Table 6 shows no differences between students based on regular eating status in terms of the food and nutrition literacy scale and its subscales. There was no statistically significant difference in the means of all subscales based on the presence or absence of nutritional regulation ( $P>0.05$ ).

## DISCUSSION

This study was conducted to investigate the food and nutrition literacy levels of middle school children. No differences were observed among students in different age groups according to the age variable. These findings are similar to our findings in Zeng *et al.* [12],

who reported that the age variable was not significant in a cross-sectional study in Chongqing, and in Ashoori *et al.* [13], who reported that the food and nutrition literacy status and associated factors in Iranian high school students. The results of Samruayruen and Kitreerawutiwong [14], who reported the definition and components of food and nutrition literacy among middle school students: a qualitative study, and the results of Doustmohammadian *et al.* [15], who reported low food and nutrition literacy (FNLIT): an obstacle to dietary diversity and nutritional adequacy in school-age children, yielded similar results.

In an examination of food and nutrition literacy in middle school children, differences were found between genders, but no statistically significant results were obtained. Pathan *et al.* [16], in their study on the relationship between nutrition literacy and nutritional status in Thai high school students and their differences by gender, found different results between genders, but no statistically significant results were obtained. Doustmohammadian *et al.* [17] in their study on food and nutrition literacy and its determinants in primary school children in Iran, no significant results were obtained based on gender. Koca and Arkan's study [18] on the relationship between nutrition literacy and eating habits in adolescents and the influencing factors also showed parallelism with our findings. Similarly, Delbosq *et al.* [19] in their study on adolescent nutrition: The role of health literacy,

**TABLE 4. ANOVA Test Results Between Scale and Subscales According to Participants' Class Variable**

Scale and subscales	Grade	n	Mean	SD	t	P-value
<b>Harmful consumption</b>	5. grade	86	9.48	1.98	0.033	0.992
	6. grade	78	9.38	2.16		
	7. grade	97	9.46	2.08		
	8. grade	113	9.45	1.95		
<b>Packaging reading</b>	5. grade	86	6.28	1.45	0.925	0.429
	6. grade	78	6.47	1.53		
	7. grade	97	6.16	1.59		
	8. grade	113	6.13	1.44		
<b>Beneficial consumption</b>	5. grade	86	6.69	1.35	1.526	0.207
	6. grade	78	6.82	1.28		
	7. grade	97	6.58	1.28		
	8. grade	113	6.94	1.25		
<b>Interaction</b>	5. grade	86	8.63	1.69	0.671	0.570
	6. grade	78	8.74	1.72		
	7. grade	97	8.45	1.80		
	8. grade	113	8.78	1.86		
<b>Total</b>	5. grade	86	31.07	3.08	1.201	0.309
	6. grade	78	31.42	3.03		
	7. grade	97	30.66	2.81		
	8. grade	113	31.30	2.95		

SD, standard deviation.

**TABLE 5. T-Test Results Between the Scale and Its Subscales According to the Family Status Variable of the Participants**

Scale and subscales	Family Status	n	Mean	SD	t	P-value
<b>Harmful consumption</b>	Nuclear family	223	9.48	2.13	0.437	0.050
	Extended family	151	9.39	1.85		
<b>Packaging reading</b>	Nuclear family	223	6.16	1.56	-1.255	0.093
	Extended family	151	6.36	1.40		
<b>Beneficial consumption</b>	Nuclear family	223	6.78	1.32	0.495	0.633
	Extended family	151	6.72	1.24		
<b>Interaction</b>	Nuclear family	223	8.66	1.78	0.149	0.942
	Extended family	151	8.63	1.76		
<b>Total</b>	Nuclear family	223	31.10	2.88	-0.030	0.262
	Extended family	151	31.11	3.08		

SD, standard deviation.

**TABLE 6. T-Test Results Between Scale and Subscales According to Participants' Regular Eating Variable**

Scale and subscales	Regular nutrition	n	Mean	SD	t	P-value
<b>Harmful consumption</b>	Yes	275	9.43	2.02	-0.219	0.491
	No	99	9.48	2.06		
<b>Packaging reading</b>	Yes	275	6.36	1.49	2.466	0.835
	No	99	5.93	1.50		
<b>Beneficial consumption</b>	Yes	275	6.79	1.27	0.767	0.488
	No	99	6.68	1.35		
<b>Interaction</b>	Yes	275	8.77	1.74	2.234	0.532
	No	99	8.31	1.81		
<b>Total</b>	Yes	275	31.36	2.91	2.779	0.572
	No	99	30.40	3.01		

SD, standard deviation.

family, and socio-demographic variables found that gender had no effect on food and nutrition literacy.

According to our research findings, the effect of the food and nutrition literacy scale and its sub-dimensions at different grade levels was not found to be statistically significant. In the study of Jung *et al.* [20], which investigated the effect of a school-based nutrition education program on healthy nutritional literacy and healthy food choices in primary school children, the findings were different from our results. It was found that as the grade level increased and that children who received nutrition education acquired healthier habits regarding nutrition. Unlike this study, Chung *et al.* [21] conducted a study on reading and understanding food and nutrition labels and nutritional behaviors of middle and high school female students, it was concluded that the grade level of the students did not affect their nutritional behaviors and knowledge levels. The results of the study titled Nutrition Able: A new tool to improve and assess the nutritional literacy of middle school children by Bolte *et al.* [22] found that nutritional literacy and food consumption did not affect grade variable. McCaughy *et al.* [23] and the results of the study on the effects of constructivist-oriented nutrition education on the nutritional knowledge, self-efficacy, and behavior of urban middle school students are parallel to our findings that the children's class status variable was not effective in the mediation analysis results of nutritional literacy and dietary diversity in the effect of

socioeconomic status on intelligence in school-aged children in Xuyong County by Qian *et al.* [24].

It was found that there was no significant difference in terms of the food and nutrition literacy scale and its sub-dimensions according to the results of nuclear family and extended family structures. Amin *et al.* [25] reported on the status and determinants of food and nutrition literacy in primary school students in Egypt: a community nurse-led design study. It was determined that family structure had no effect on children's nutritional knowledge level. Bookari [26] also showed similar results in a cross-sectional exploratory study on food literacy among Saudi parents of adolescent children aged 10-19. The results of Anderson and Falkenberg [27] on the role and status of food and nutrition literacy in the Canadian school curriculum and Li *et al.* [28] on the relationship between family nutrition environment and food and nutrition literacy in Chinese school-aged children showed different results from our findings. It was concluded that as the family's knowledge level about nutrition increases, children's eating habits become balanced and adequate. Xu *et al.* [29] The results of the study "Effects of parental food education on children's food literacy: The mediating role of parent-child relationship and learning motivation" also argue that families have a supportive role in food and nutrition literacy.

From our findings, it was concluded that there was no statistically significant difference according to

regular eating status in terms of food and nutrition literacy scale and its subdimensions. This finding of ours; According to the results of the study conducted by Hoteit *et al.* [30] on the status and relationships of food and nutrition literacy among parent-adolescent dyads: Findings from 10 Arab countries, it was found that the relationship between regular eating habits of adolescents and food and nutrition literacy was correlated in some countries but did not affect it in other countries. Pathan *et al.* [14] concluded that the relationship between nutrition literacy and nutritional status in Thai high school students and differences by gender did not differ according to gender and nutritional status. The results of a study conducted by Jiang and Mao [31] on the cognitive abilities of middle school students in Beijing, China in 2020 and the application of food nutrition labels are also similar to our findings. Hashemzadeh *et al.* [32] nutrition literacy and eating habits in children from food insecure and food insecure households: A cross-sectional study and Hoteit *et al.* [33] found that regular and balanced nutrition has a significant effect on food and nutrition literacy, unlike our findings in the results of the food literacy and healthy nutrition study in childhood and adolescence.

### Strengths and Limitations

This study, which examines the food and nutrition literacy levels of middle school-aged children, will contribute to determining their nutritional habits, daily quality of life, and health levels. The study included middle school-aged children. The study results can only be generalized to the sample group in question.

### CONCLUSION

The food and nutrition literacy levels of middle school children are crucial for their nutritional habits and will continue to be important in later developmental stages. Certain factors directly or indirectly influence children's food and nutrition literacy. Our research results indicate that age, gender, grade, family status, and nutritional status do not affect middle school children's food and nutrition literacy, but they do create significant differences within themselves. Further studies and research are recommended to examine the impact of different variables.

### Ethics Approval and Consent to Participate

The study was approved by the Cyprus Science University Ethics Committee (Decision no: 2025/01.002, Date: 21.01.2025). All procedures performed during data collection, review of patient records, and study implementation complied with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its subsequent amendments. To avoid any ethical violations within the scope of the research, a consent form was obtained from the middle school children and an informed consent form was obtained from their parents.

### Data Availability

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

### Authors' Contribution

Study Conception: ÇMH, MZA, SC, DDK; Study Design: ÇMH; Supervision: MZA, Funding: SC; Materials: SC; Data Collection and/or Processing: DDK; Statistical Analysis and/or Data Interpretation: ÇMH; Literature Review: ÇMH; Manuscript Preparation: ÇMH; Writer: ÇMH; and Critical Review: ÇMH.

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The author(s) disclosed no conflict of interest during the preparation or publication of this manuscript.

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The author(s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author(s)

in accordance with scientific research methods and academic ethical principles.

### Editor's Note

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## REFERENCES

- Truman E, Raine K, Mrklas K, et al. Promoting children's health: Toward a consensus statement on food literacy. *Can J Public Health*. 2017;108(2):e211-e213. doi: 10.17269/CJPH.108.5909.
- Vidgen HA, Gallegos D. Defining food literacy and its components. *Appetite*. 2014;76:50-59. doi: 10.1016/j.appet.2014.01.010.
- Zoellner J, Connell C, Bounds W, Crook L, Yadrick K. Nutrition literacy status and preferred nutrition communication channels among adults in the Lower Mississippi Delta. *Prev Chronic Dis*. 2009;6(4):A128.
- WHO. Obesity and overweight. <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.2024>. Access Date: 28.09.2025.
- Demiray G, Yorulmaz F. Halk Sağlığı Bakışıyla Obezite Yönetimi [Obesity Management with A Public Health Perspective]. *Sağlık Bil Değer*. 2023;13(1):147-155. doi: 10.33631/sabd.1101432. [Article in Turkish]
- GBD 2017 Diet Collaborators. Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2019;393(10184):1958-1972. doi: 10.1016/S0140-6736(19)30041-8.
- Mollborn S, Lawrence E. Family, Peer, and School Influences on Children's Developing Health Lifestyles. *J Health Soc Behav*. 2018;59(1):133-150. doi: 10.1177/0022146517750637.
- Brown JE, editor. *Nutrition Through the Life Cycle*. 8th edition. Cengage Learning, Inc., 2024.
- Karagöz Y. SPSS-AMOS-META Uygulamalı İstatistiksel Analizler [Applied Statistical Analyses]. Ankara: Nobel Akademik Yayıncılık, 2020. [Book in Turkish]
- Büyüköztürk Ş. Sosyal Bilimler için Veri Analizi El Kitabı: İstatistik, Araştırma Deseni SPSS Uygulamaları ve Yorum. [Data Analysis Handbook for Social Sciences: Statistics, Research Design, SPSS Applications and Interpretation], 31st Edition. Ankara: Pegem Akademi Yayıncılık, 2024. [Book in Turkish]
- Tanış-Özçelik A, Yılmaz E, Özmaldar R. Çocuklar için Gıda ve Beslenme Okuryazarlık Ölçeği'nin Geliştirilmesi: Geçerlik ve Güvenirlik Çalışmaları [Development of the Food and Nutrition Literacy Scale for Children: Validity and Reliability Study]. *Türk Eğitim Bilimleri Dergisi*. 2024;22(3):1857-1876. doi: 10.37217/tebd.1513748. [Article in Turkish]
- Zeng M, Zhu Y, Cai Z, et al. Nutrition Literacy of Middle School Students and Its Influencing Factors: A Cross-Sectional Study in Chongqing, China. *Front Public Health*. 2022;10:807526. doi: 10.3389/fpubh.2022.807526.
- Ashoori M, Omidvar N, Eini-Zinab H, et al. Food and nutrition literacy status and its correlates in Iranian senior high-school students. *BMC Nutr*. 2021;7(1):19. doi: 10.1186/s40795-021-00426-2.
- Samruayruen K, Kitreerawutiwong N. Exploration of the definition and components of food and nutrition literacy among junior secondary school students: a qualitative study. *BMC Nutr*. 2022;8(1):27. doi: 10.1186/s40795-022-00519-6.
- Doustmohammadian A, Omidvar N, Keshavarz-Mohammadi N, et al. Low food and nutrition literacy (FNLIT): a barrier to dietary diversity and nutrient adequacy in school age children. *BMC Res Notes*. 2020;13(1):286. doi: 10.1186/s13104-020-05123-0.
- Pathan N, Yangyuen S, Somdee T. The relationship of nutrition literacy to nutrition status and differences by gender in Thai high school students. *Int J Public Health Sci* 2025;14(2):860-868. doi: 10.11591/ijphs.v14i2.25365.
- Doustmohammadian A, Keshavarz Mohammadi N, Omidvar N, et al. Food and nutrition literacy (FNLIT) and its predictors in primary schoolchildren in Iran. *Health Promot Int*. 2019;34(5):1002-1013. doi: 10.1093/heapro/day050.
- Koca B, Arkan G. The relationship between adolescents' nutrition literacy and food habits, and affecting factors. *Public Health Nutr*. 2021;24(4):717-728. doi: 10.1017/S1368980020001494.
- Delbosq S, Velasco V, Vercesi C, Gruppo Regionale Hbsc Lombardia, Vecchio LP. Adolescents' Nutrition: The Role of Health Literacy, Family and Socio-Demographic Variables. *Int J Environ Res Public Health*. 2022;19(23):15719. doi: 10.3390/ijerph192315719.
- Jung T, Huang J, Eagan L, Oldenburg D. Influence of school-based nutrition education program on healthy eating literacy and healthy food choice among primary school children. *Int J Health Prom Educ*. 2019;57(2):67-81. doi: 10.1080/14635240.2018.1552177.
- Chung EJ, Jeon JS, Ahn HS. Reading and Understanding of Food & Nutrition Labels and Dietary Behaviors of Female Middle and High School Students. *J Korean Diet Assoc*. 2010;16(3):239-254.
- Bolte J, Abalos J, Johnson J, et al. Nutrition Able: A novel tool for improving and assessing nutritional literacy of middle school children. *MedRxiv*. 2025 July 23. doi: 10.1101/2025.07.20.25331738.
- McCaughy N, Fahlman, M, Martin JJ, Shen B. Influences of Constructivist-Oriented Nutrition Education on Urban Middle School Students' Nutrition Knowledge, Self-Efficacy, and Behaviors. *Am J Health Educ*. 2011;42(5):276-285. doi: 10.1080/19325037.2011.10599198.
- Qian Y, Su Q, Liu W, Ma L, Ma M, Ma L. The influence of socioeconomic status on intelligence in school-age children in Xuyong County: a mediation analysis of nutrition literacy and dietary diversity. *Eur J Nutr*. 2025;64(2):100. doi: 10.1007/s00394-025-03599-9.
- Amin SM, Dreidi M, Ghallab E, Morsy Mohamed SR,

- Alrimawi I. The Status of Food and Nutrition Literacy and its determinants among Elementary School students in Egypt: community nursing-led design. *BMC Nurs.* 2024;23(1):708. doi: [10.1186/s12912-024-02342-9](https://doi.org/10.1186/s12912-024-02342-9).
26. Bookari K. A cross-sectional exploratory study of food literacy among Saudi parents of adolescent children aged 10 to 19 years. *Front Nutr.* 2023;9:1083118. doi: [10.3389/fnut.2022.1083118](https://doi.org/10.3389/fnut.2022.1083118).
27. Anderson H, Falkenberg T. The Role and Status of Food and Nutrition Literacy in Canadian School Curricula. *Alberta J Educ Res.* 2016;62(1):87-109. doi: [10.11575/ajer.v62i1.56182.401](https://doi.org/10.11575/ajer.v62i1.56182.401).
28. Li N, Su X, Liu T, Sun J, Zhu W. Relationships of Family Food Environment with Food and Nutrition Literacy in Chinese School-Age Children. *Research Square.* 2020 Jun 3. doi: [10.21203/rs.3.rs-32377/v1](https://doi.org/10.21203/rs.3.rs-32377/v1).
29. Xu X, Cai H, Zhang J, Xia T. The Effects of Parental Food Education on Children's Food Literacy: The Mediating Role of Parent-Child Relationship and Learning Motivation. *Nutrients.* 2024;16(15):2564. doi: [10.3390/nu16152564](https://doi.org/10.3390/nu16152564).
30. Hoteit M, Mansour R, Mohsen H, et al; regional food literacy group. Status and correlates of food and nutrition literacy among parents-adolescents' dyads: findings from 10 Arab countries. *Front Nutr.* 2023;10:1151498. doi: [10.3389/fnut.2023.1151498](https://doi.org/10.3389/fnut.2023.1151498).
31. Jiang Y, Mao T. A Survey on Cognitive Ability and Application of Food Nutrition Labels of Middle School Students in Beijing, China in 2020. *J Food Nutr Res.* 2021;9(4):223-239. doi: [10.12691/jfnr-9-4-8](https://doi.org/10.12691/jfnr-9-4-8).
32. Hashemzadeh M, Akhlaghi M, Akbarzadeh M, Nabizadeh K, Miri HH, Kazemi A. Nutrition literacy and eating habits in children from food-secure versus food-insecure households: A cross-sectional study. *Medicine (Baltimore).* 2024;103(39):e39812. doi: [10.1097/MD.00000000000039812](https://doi.org/10.1097/MD.00000000000039812).
33. Hoteit M, Qasrawi R, Tayyem R. Editorial: Food literacy and healthy diets in childhood and adolescence. *Front Nutr.* 2024;11:1366912. doi: [10.3389/fnut.2024.1366912](https://doi.org/10.3389/fnut.2024.1366912).

# Health Practices of Turkish Expectant Mothers

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## Abstract:

**Objective:** Health practices during pregnancy are important to support mother - child health and the safety of the delivery. Defining these health practices can help to support vulnerable groups at risk. This study aims to determine the health practices of Turkish expectant mothers and analyze related factors.

**Methods:** A total of 350 pregnant women were reached in this cross-sectional study from a state hospital in İstanbul during their prenatal visits. Data were collected with a Personal Information Form and Health Practices in Pregnancy Questionnaire-II (HPQ-II).

**Results:** Most (65.1%, n=228) were between 18-31 years, mean age 29.69±6.61 (18-45) years, with junior high school degree (55.7%, n=195), and housewives (90.3%, n=316). Nearly all (98.6%, n=345) followed routine examinations, were in the second trimester (51.7%, n=181), had planned pregnancy (86.6%, n=303), but had no pregnancy school attendance (96.6%, n=338). For most expectant women (55.7%, n=195), doctors were information resources. The average HPQ-II score was 108.76±5.36 (93-123). Analysis results emphasize a significant difference between education level, smoking behavior, stillbirth, and the HPQ-II score. Especially, elementary school graduate women, smokers, and those with stillbirth experience had a lower HPQ-II score (P<0.05).

**Conclusion:** Study results indicate the importance of improving the education level of women in mother and child health care and community health. Communities with higher levels of education will also contribute to better health practices. However, indicators like smoking behavior and previous history of stillbirth can also be considered important risk factors for lower health practices in pregnancy.

**Keywords:** Pregnancy, Healthy Lifestyle, Women, Public Health, Midwifery, Nurses

Health practices during pregnancy are important activities which have important impact on health of the pregnant woman, fetus, and newborn. All practices include targeted activities to achieve the healthy pregnancy outcomes. It is of great importance for the health of the mother and baby to take care of their health at all stages. These health practices during pregnancy consists of balanced nutrition/nutrition, weight control, regular exercise, oral and dental care, education about pregnancy and

birth, smoking, drinking alcohol, and the use of illegal substances drugs, risky sexual behaviors and attitudes, and protection from infectious agents [1]. Neglecting health practices increases the risk of complications related to the whole pregnancy period and birth, which cause a serious threat to maternal and infant health, and also, hence, amplifying the mortality and morbidity rates. It is a crucial protection step for pregnant women to take these practices as a necessity. Mothers and candidates must take responsibility and

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take action to stay emotionally and physically healthy for themselves and their baby [2]. The midwife is responsible for providing professional initial and ongoing comprehensive support that includes mother-child health, prenatal, birth, and postnatal care services. They work at clinical-based and also community-based health centers and reach women before pregnancy, during pregnancy, during labor, and even after the delivery. They have a noteworthy place in determining, monitoring, and providing training on health practices and behaviors [3, 4]. While more research is needed on this topic, some studies reveal aspects of healthcare practices during pregnancy in Türkiye. Beyaz *et al.* [5] from the eastern part of Türkiye presented data from Muş city. In this study, pregnancy health practices were found to be affected by the working status, educational level, family structure, first motherhood age, number of pregnancies, birth experience, preferred delivery type, whether the pregnancy is planned or not, routine check-up status, and the number of check-ups. Prenatal and postnatal training programs for pregnant women and their families should be expanded, and participation in these programs should be encouraged [5]. Healthcare practices are quite effective. While compliance contributes positively to quality of life [6], high maternal anxiety levels can negatively affect healthcare practices. The opposite is also true [7]. The limited existing literature on this subject indicates that more research is needed. This study aimed to determine health practices in pregnant women and to specify the factors associated with these practices. These findings will give some more insight into sensitive and vulnerable groups to take preventive precautions and also emphasize the role and responsibilities of midwives.

## METHODS

### Ethical Approval, Informed Consent, and Permissions

Ethical approval for the study was obtained from the Clinical Research Ethics Committee of Istanbul University-Cerrahpaşa (07.05.2019/ A-33). The necessary institutional permissions were obtained from the Istanbul Health Directorate to conduct the study at a state hospital in Istanbul. The principles of

the "Declaration of Helsinki" were adhered to throughout the study. Pregnant women interviewed throughout the study were informed about the purpose, importance, and possible publication platforms. Confidentiality of information was maintained. Informed consent was obtained from pregnant women who freely consented. Informed consent was obtained from pregnant women who voluntarily agreed to answer the survey questions.

### Research Design and Sample

The study population consisted of pregnant women visiting antenatal outpatient clinics for their routine examinations at a state training and research hospital in Istanbul. Based on the estimated number of total births (n=3900) at this hospital, a sample size with a 95% confidence interval of 350 pregnant women. Pregnant women were volunteers in this study. However, additional criteria for the sampling were;

- Expectant mothers between 18 and 45 ages
- Fluent in Turkish and no communication problem
- Reading and signing the informed consent form.

Pregnant women who did not meet these criteria and those with acute pregnancy complications were not included in the study.

### Data Collection Methods

The Personal Information form developed by the researcher in light of the relevant literature. Data in this form was collected under sociodemographics (age, education, marriage age, occupation, workin status, spouses's education, spouse job, income level, family type etc.), social support features (spouse support, family and social support etc.), obstetric informations (number of pregnancy, living children, stillbirth experience, first pregnancy age, pregnancy week, planed pregnancy, risky pregnancy), health and medical data (chronical disease situation, regular medication use, body mass index, weight gain during pregnancy), pre-pregnancy health practices (doctor vists when ill, regular dictor visit behaviour, weight control, balanced nutrition, regular excercise, smoking, alcohol behaviour, hobby practices, participating in health trainings) [1, 2, 4, 5]. The data collection tool was the Health Practices in Pregnancy Questionnaire-II (HPQ-II), developed by Lindgren [1]

in 2001 and updated in 2005. The Turkish validity and reliability study of HPQ-II was published by Er [8]. This tool consists of 34 items. However, during the Turkish validity and reliability study, the “marijuana use” item was because of low average score in internal validity and reduced to 33 items. The scale is rated over a five-point scale Likert type scale ranging from one (never) to five (always). The items measure the qualification of health practices. It includes questions related with balance of rest and exercise, safety measures, nutrition, avoiding the use of harmful substances, obtaining health care, and obtaining information. In the questionnaire the items 6, 7, 21, 22, 23, 24, 25, 26, 32, and 33 are coded reversely from 5 to 1. Total score range were between 33-165. The Cronbach alpha of the Turkish version was 0.74 in the Turkish validity and reliability study. High scores indicate a good level of health practices [8]. Deniz and Bayraktar [6] found the Cronbach's alpha 0.68. However, the Cronbach's alpha value of this study group was 0.55. The researchers' registration, assignment, follow-up, and analysis steps were compliant with the strengthening the reporting of observational studies in epidemiology (STROBE) statement guidelines [9]. Expectant mothers who visit the outpatient clinic for routine controls were invited to participate in this study. After information sharing about the purpose of the study and informed consent, women fill out the data collection form themselves.

### Statistical Analysis

Data were analyzed with SPSS 24.0 for Windows (SPSS, INC., Chicago, IL) statistical program. Descriptive and analytical analysis were used. Number, percentage, arithmetic mean, and standard deviation values were used in descriptive statistics for the data analysis. The normality of the data distribution was assessed using Skewness-Kurtosis values and the Kolmogorov-Smirnov test (+1 and -1). While the independent samples t-test was used for the variables in which two independent groups were compared were normally distributed. The Mann-Whitney U test was used for the variables that did not show normal distribution. In order to compare more than two groups, One-Way Analysis of Variance (ANOVA) was used for the normally distributed variables, and the Kruskal-Wallis test was used for non normally

distributed variables. Homogeneity of variances was determined by Levene's test. As a multiple comparison test, LSD Post Hoc test was used if the variances were equal. Dunnett T3 Post Hoc was used if variances were not equal. The Pearson correlation (r) test was used to test relationship of some variables. Significance value P under the value of  $P < 0.05$  was considered as statistically significant in the study. The results were evaluated at a confidence of 95%.

### RESULTS

According to the socio-demographics, most (65.1%,  $n=228$ ) were between 18-31 years, have 8 years of basic education (70%,  $n=245$ ), are housewives (90.3%,  $n=316$ ), no active work life (98.3%,  $n=344$ ), all married, and 97.7% ( $n=342$ ) got married with  $\geq 18$  years of age and no consanguineous marriage (97.1%,  $n=340$ ) (Table 1). More than half of the spouses (63.7%,  $n=223$ ) also had basic education ( $\geq 8$  years) and worked as civil servants (71.4%,  $n=250$ ). Most pregnant women (92%,  $n=322$ ) reported their economic level as income equal to expenses, and live as a nuclear family (94.3%,  $n=330$ ). Support from spouse (90.9%,  $n=318$ ) and social environment (97.4%,  $n=341$ ) was defined by the women as sufficient. Socio-demographic features frequency, and their comparisons according to mean health practices scores (HPQ-II) are also shown in Table 1. Mean value comparisons were similar among groups ( $P > 0.05$ ). State of health data and pre-pregnancy health behaviors are given in Table 2. Most (97.7%,  $n=342$ ) have no chronic disease. According to the BMI, 34.9% ( $n=122$ ) were in normal limits, 28.5% ( $n=100$ ) overweight (BMI 25-30), and 36.6% ( $n=126$ ) obese (BMI  $\geq 30$ ). Most (94%,  $n=329$ ) reported not being able to manage weight. A main part (92.9%,  $n=325$ ) do not visit a doctor in every illness situation, do not exercise regularly (93.5%,  $n=327$ ), have no hobbies (91.1%,  $n=319$ ), and do not participate in health education programs (98%,  $n=343$ ). None of the women reported alcohol, drug use before the pregnancy. However, 2.3% ( $n=78$ ) reported smoking before pregnancy. According to the HPQ-II average scores comparisons, mean value distributions show similarities according to chronic disease, body mass index, doctor visit behavior, managing normal weight,

**TABLE 1. Health Practices in Pregnancy Score (HPQ-II) According to Sociodemographics (n=350)**

Variables	n	%	Mean±SD	t/ F	P-value
<b>Age</b>					
18-31	228	65.1	109.08±5.52	1.52	0.13
32-45	122	34.9	108.17±5.02		
<b>Education</b>					
8 years	245	70.0	108.60±5.61	0.92	0.36
≥9 years	105	30	109.14±4.73		
Elementary	50	14.3	105.86±5.74		
Junior Highschool	195	55.7	109.30±5.37	5.99	0.001
Highschool	86	24.6	109.08±4.82		
University and more	109.42	5.4	109.42±4.43		
<b>Occupation</b>					
Housewife	316	90.3	108.68±5.31	0.47	0.70
Labourer	22	6.3	109.63±6.31		
Civil servant	7	2.0	108.42±5.31		
Freelance	5	1.4	110.80±4.81		
<b>Work status</b>					
Employer	6	1.7	110.16±2.92	0.65	0.52
Unemployed	344	98.3	108.74±5.39		
<b>Marriage age</b>					
<18 years	8	2.3	111.37±3.06	1.39	0.16
≥18 years	342	97.7	108.70±5.39		
<b>Consanguineous marriage</b>					
Yes	10	2.9	110.30±6.21	0.91	0.36
No	340	97.1	108.71±5.34		
<b>Spouse's education</b>					
8 years	223	63.7	108.75±5.63	0.036	0.97
≥9 years	127	36.3	108.77±4.86		
<b>Occupation</b>					
Labourer	9	2.6	105.55±5.19	0.18	0.83
Civil servant	250	71.4	108.50±5.47		
Freelance	91	26	109.80±4.89		
<b>Income level</b>					
Less than expense	14	4	110.07±2.70	1.52	0.22
Equal	322	92	108.80±5.45		
More than expense	14	4	106.64±4.79		
<b>Family type</b>					
Nuclear type	330	94.3	108.76±5.36	0.05	0.96
Big family	20	5.7	108.70±5.48		
<b>Spouse support</b>					
Sufficient	318	90.9	108.66±5.38	1.16	0.24
Inufficient	32	9.1	109.81±5.10		
<b>Environmental support</b>					
Sufficient	341	97.4	108.76±5.39	0.007	0.99
Inufficient	9	2.6	108.77±4.20		

SD, Standard deviation. t, Independent sample t-test. F, Tested by one-way ANOVA with post-hoc Bonferoni test. Statistically significant P-values are shown in bold.

**TABLE 2. Health Practices in Pregnancy Score (HPQ-II) According to State of Health and Pre-Pregnancy Health Behaviors (n=350)**

Variables	n	%	Mean±SD	t / F	P-value
<b>Chronic disease</b>					
Yes	8	2.3	111.50±4.34	1.46	0.14
No	342	97.7	108.70±5.37		
<b>Body Mass Index (BMI)</b>					
Normal (20-25)	122	34.9	108.49±5.23	1.63	0.197
Overweight (25-30)	100	28.5	109.58±5.49		
Obese (≥30)	128	36.6	108.76±5.36		
<b>Visit doc when ill</b>					
Yes	25	7.1	108.76±5.40	0.006	0.996
No	325	92.9	108.76±5.36		
<b>Manage normal weight</b>					
Yes	21	6	109.28±6.84	0.45	0.64
No	329	94	108.73±5.26		
<b>Exercise routinely</b>					
Yes	23	6.6	109.65±6.00	0.82	0.41
No	327	93.4	108.70±5.32		
<b>Smoke</b>					
Yes	78	2.3	107.01±4.86	3.32	<b>0.001</b>
No	272	77.7	109.26±5.40		
<b>Hobbies</b>					
Yes	31	8.9	105.80±5.31	3.26	<b>0.001</b>
No	319	91.1	109.05±5.28		
<b>Attend health education</b>					
Yes	7	2	109.85±4.77	0.54	0.59
No	343	98	108.74±5.37		

SD, Standard deviation. t, Independent sample t-test. F, Tested by one-way ANOVA with post-hoc Bonferoni test. Statistically significant P-values are shown in bold.

exercising routinely, and attending health education programs ( $P>0.05$ ) (Table 2). However, significance was seen in smoking and also hobby activities. Non-smokers ( $109.26\pm5.40$ ) had significantly higher HPQ-II scores than smokers ( $107.01\pm4.86$ ) and those who do not have any hobbies ( $109.05\pm5.28$ ) also had higher scores than the group ( $105.80\pm5.31$ ) with hobbies ( $P=0.001$ ).

The distribution of obstetrics and pregnancy monitoring features and HPQ-II mean score comparisons are given in Table 3. More (51.4%,  $n=180$ ) than half of the women have no birth

experience, median values were pregnancy was 2 (min-max= 1-6), number of living children 1 (min-max= 0-6), stillbirth 0 (min-max= 0- 1), spontaneous abortion 0 (min-max= 0-1). none of the women had a curettage. Most (51.7%,  $n=181$ ) of the women were in the second trimester, followed by the third trimester (37.7%,  $n=132$ ). Mean gestational week was  $24.85\pm8.69$  (range: 10-40). Most (86.6%,  $n=303$ ) had a planned pregnancy, followed their routine pregnancy follow-ups (98.6%,  $n=345$ ), and had not attended a prenatal education program (96.6%,  $n=338$ ). Their information resource was mainly the doctor (55.7%,

**TABLE 3. Health Practices in Pregnancy Score (HPQ-II) According to Obstetric Features and Pregnancy Monitoring (n=350)**

Variables	n	%	Mean±SD	t / F	P-value
<b>Birth experience</b>					
No	170	48.6	108.85±5.79	0.31	0.75
Yes	180	51.4	108.67±4.93		
<b>Trimester week</b>					
First (1-13 week)	37	10.6	108.78±5.05	0.37	0.98
Second (14-27 week)	181	51.7	108.90±5.46		
Third (28-40 week)	132	37.7	108.57±5.34		
<b>Planned pregnancy</b>					
Yes	303	86.6	108.58±5.39	1.61	0.10
No	47	13.4	109.93±5.08		
<b>Routine antenatal examinations</b>					
Yes	345	98.6	108.73±5.36	0.85	0.39
No	5	1.4	110.80±5.35		
<b>Pregnancy course attendance</b>					
Yes	12	3.4	107.08±4.69	1.10	0.27
No	338	96.6	108.82±5.38		
<b>Information source</b>					
Doctor	195	55.7	108.59±5.40	0.41	0.79
Midwife	9	2.6	108.11±4.98		
Internet	93	26.6	108.83±5.37		
TV	30	8.6	109.90±6.26		
Friends	23	6.6	108.69±6.26		

SD, Standard deviation. t, Independent sample t-test. F, Tested by one-way ANOVA with post-hoc Bonferoni test.

n=195) followed by internet/social media (26.6%, n=93), TV (8.6%, n=30), friends (6.6%, n=23), midwives (2.6%, n=9), but no nurses. In this context, HPQ-II mean score distributions showed a similar distribution between the groups in all variables ( $P>0.05$ ).

At final stage a correlation analysis was conducted including age, education level (primary school, secondary school, high school, university), marriage age, income level, first pregnancy age, gestational week, number of pregnancies, living children, stillbirths, spontaneous abortions, body mass index value, and total HPQ-II scores (Table 4). Despite mothers' education level and stillbirth number, other variables show similar correlation with total HPQ-II scores ( $P>0.05$ ). However, mothers' education level

increase correlated with a higher total HPQ-II score ( $r=0.141$ ;  $P=0.008$ ). Just the opposite number of stillbirths and the total HPQ-II score ( $r=-0.123$ ;  $P=0.021$ ) were inversely correlated. A total of 7 mothers in our study group had experienced one stillbirth.

## DISCUSSION

Our study group was a young group of women between 18-31 years old, junior high school graduates (55.7%), and housewives (90.3%). In Türkiye Demographic and Health Survey (TDHS) results, highest age-specific fertility rate is in the range of 25-29 years, our results also shows a similar age range

with TDHS. According to TDHS 2018, 14.5% of the female population is within the 30-34 age range, and 15% of them are placed in the 35-39 age group. 41% of women have a high school and higher education and 28% are working [10]. Our study, compared with TDHS 2018, the difference in education level stands out. According to the latest country data, there is an increase in the education level of women between the ages of 15-49 in Turkey.

Study results using the HPQ-II comparisons show differences. Our score was  $108.76 \pm 6.61$  (range: 93-123) in this study. Er's [8] found HPQ-II score of  $124.12 \pm 12.09$  in the first institution and  $130.26 \pm 10.79$  in the other institution. In another study Tirkeş [11] found a mean HPQ-II score as  $121.57 \pm 1.53$  (range: 87-149). In Lindgren's [1] study, the scale score was  $138.49 \pm 12.42$  (range: 100-163). In another study, the mean HPQ-II score was  $112.64 \pm 13.87$  (range: 73-141) [12]. Our HPQ-II scale values were similar in comparison to the literature. Moreover, a significant difference was found between the HPQ-II score and education level, smoking rate in this study. Increase in education level also supported higher HPQ-II score. However smoker expectant women show lower health practices scores. These results indicate insufficient health practices in smokers and lack of knowledge in

pregnancy health practices. Education level and smoking behavior are determined as key parameters in health practices and scores. These results showed similarities with other literature which suggests that the health awareness and healthy lifestyle behaviors become the proportional to the level of education [13-17]. In a study by Solmaz and Şahin [18], 44.3% of pregnant participants were in the 17-25 age group, and the mean age was  $26.84 \pm 5.32$ . While there was no significant difference between the age groups across studies, the mean ages were similar. In the same study, 36.7% of pregnant women were high school graduates, and 70.92% were housewives. In the study by Kaya and Gölbaşı [19], mean age was  $26.62 \pm 4.00$ , 63.6% were 26 years of age or older, and 42.4% were high school graduates. When the participant groups in these three studies were examined, it was seen that the participants in our study had a significantly lower level of education and were not actively working. Participants' sociodemographic characteristics and scale scores revealed a significant difference between them and their level of education. As participants' level of education increases, their scale scores increase, suggesting they have positive health practices. Studies by Solmaz and Şahin [18], Beyaz *et al.* [5], and Kaya and Gölbaşı [19] also found similarities between education levels and HPQ-II scale scores. An examination of the participants' general health status and habits before pregnancy revealed that 2.3% of them were smokers. Similar studies in the literature have found no association between smoking and HPQ-II scores. This study found significantly lower scale scores in pregnant women who smoked before pregnancy. This suggests that pregnant women who smoke have poor health practices. Smoking is a serious public health problem worldwide. During pregnancy, it has short- and long-term negative effects on both the mother and the fetus. It can lead to congenital anomalies and even fatal fetal consequences, including death. It is crucial for expectant mothers to abandon negative habits and focus on positive ones. In light of data on obstetric characteristics and habits, no significant difference was found between the scores obtained by pregnant women according to different habits. In this study, 51.4% of pregnant women were multiparous, 51.7% were in the second trimester, and 86.6% planned this pregnancy. 98.6% of pregnant women attended routine

**TABLE 4. Correlation Analysis of Selected Variables and Total HPQ-II Score (n=350)**

Variables	HPQ-II Score	
	r	P-value
Age	-0.023	0.670
Education level	0.141**	<b>0.008</b>
Marriage age	-0.068	0.206
Income level	-0.091	0.091
Number of pregnancies	-0.047	0.378
Number of alive children	-0.022	0.688
Number of stillbirths	-0.123*	<b>0.021</b>
Number of spontaneous abortions	-0.038	0.483
First pregnancy age	-0.068	0.206
Pregnancy week	-0.031	0.557
Body Mass Index	-0.019	0.723

HPO-II, Health Practices in Pregnancy Questionnaire-II; r, Pearson correlation coefficient.

Statistically significant P-values in bold.

follow-ups. In a study conducted by Beyaz *et al.* [5], 67.7% of pregnant women were multiparous, 96.5% were in the second trimester, 75.3% had planned pregnancies, and 74.1% attended routine check-ups. While participant characteristics were similar between the two studies, the fact that 98.6% of pregnant women attended routine check-ups aligns with the Turkish average. In Turkey, 90% of pregnant women received at least one prenatal care visit, and 96% received at least 4 prenatal care visits [20]. The higher rate in this study is due to the number of participants and the fact that it is a regional study. In this study, 55.7% of pregnant women emphasized that they received information about their pregnancies and births from doctors, 26.6% from the internet, and 2.6% from midwives. In our study, the rate of prenatal care among pregnant women was high, but the low rate of information received from midwives suggests difficulty in reaching midwives during this process and the disruption of midwifery services. Gök *et al.* [21] reported that 70% of pregnant women received information from doctors, 55.6% from midwives/nurses, and 58.8% from the internet. Another study from Türkiye [22] reported receiving information from healthcare professionals to be 57.7% and 42.3% from the internet. While the rate of receiving information from doctors/healthcare workers is high, the rate of receiving information from the internet is significantly higher. This data demonstrates the significant role technology has taken in our lives, suggesting that it is a source of information as much, and sometimes even more, than that of a professional. Mean score values of this study ( $109.22 \pm 5.96$ ) were lower than other study results from Türkiye. Including Er [5] who reported findings from two centers as  $124.12 \pm 12.09$  and  $130.26 \pm 10.79$ . Tirkeş [11]  $121.57 \pm 1.53$ , Beyaz *et al.* [5]  $109.8 \pm 12.9$ , Balaban and Özkan [23]  $118.86 \pm 17.19$ , Bayrak and Kanbur [22]  $123.01 \pm 9.39$ , Gök *et al.* [21] as  $97.53 \pm 11.59$ , Kaya and Gölbaşı [19]  $121.57 \pm 10.3$ , and Solmaz and Şahin [18]  $103.90 \pm 15.46$ . The studies were conducted in different provinces in Türkiye, and the fact that the results did not differ significantly suggests that a general health attitude has emerged. Common points in the studies are that the education level is generally secondary or high school, and pregnant women frequently use the internet as a source of information. When the correlation analyses of the

factors related to the health practices of the participating pregnant women were examined, the HPQ-II scale correlation with age, income status, age of marriage, number of pregnancies, number of living children, number of spontaneous abortions, age at first pregnancy, gestational week and body mass index values showed a similar distribution. Pregnant women's level of education was found to be significantly correlated with their HPQ-II scores. As their level of education increases, so do their scale scores. In the study, 70% of pregnant women had completed eight years of education, and 30% had a university degree. The maximum possible score on the scale was 165, while the highest score in this study was 123. According to the data, it is predicted that higher levels and years of education can lead to higher scale scores, thus enabling pregnant women to adopt healthier practices. Correlation analysis revealed a significant relationship between the HPQ-II total score, education level, and the number of stillbirths. An inverse relationship was found between the number of stillbirths and the HPQ-II total score ( $r = -0.123$ ;  $P = 0.021$ ). Data indicate that as education level increases, the scale score increases, while the number of stillbirths decreases. As education level increases, pregnant women become more selective about their own and their baby's health, taking preventative steps to improve their health. A woman's increased education level and health literacy are important indicators of increasing the development level of herself, her family, and the country in which she lives.

### Strengths and Limitations

**The strengths and limitations of the study are listed as follows:**

*Strengths:* Data collected directly through face-to-face interviews, and providing information on specific, period-specific health practices, such as those related to pregnant women.

*Limitations:* Findings are limited by participants' reports. Particularly, statements regarding smoking, alcohol, and drug use are accepted as is. It is not possible to comment on the results for larger populations. More comprehensive quantitative and qualitative studies on the subject are needed. Larger databases will contribute to broadening the scope of the topic.

## CONCLUSION

In conclusion, this study revealed the health practices of Turkish expectant mothers and analyzed related factors. Study results indicate the importance of improving the education level of women. Higher education level will contribute to improved health awareness and health practices. However, study results show also that indicators like smoking behavior and previous history of stillbirth can also be considered important risk factors for lower health practices in pregnancy. Special programs for women should be developed in smoking cessation programs. A common health like overweight, obesity indicate insufficiency in weight control correlated with wrong eating habits and sedentary life style. Women-oriented and pregnancy programs should be developed for weight control and balanced nutrition. Women from all socioeconomic levels can be reached through state and private hospitals' pregnancy education programs and community-based education programs including Family Health Centers. Health care professionals like nurses and midwives are in the key position to provide care for expectant mother as an educator and consultant, as a source of more information, at all stages before pregnancy, during pregnancy, delivery and after birth.

### *Ethics Approval and Consent to Participate*

This study was approved by the İstanbul University-Cerrahpaşa Clinical Research Ethics Committee (Decision No: A-33; date: 17.05.2019). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Informed consent was obtained from pregnant women who freely consented. Informed consent was obtained from pregnant women who voluntarily agreed to answer the survey questions.

### *Data Availability*

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

### *Authors' Contribution*

Study Conception: BA; Study Design: BA, ÖG, ME, ŞY; Supervision: BA, ÖG, ME, ŞY; Funding: BA, ÖG; Materials: BA, ÖG; Data Collection and/or Processing: BA, ÖG, ME, ŞY; Statistical Analysis and/or Data Interpretation: BA, ÖG, ME; Literature Review: BA, ÖG; Manuscript Preparation: BA, ÖG, ME; and Critical Review: BA, ÖG, ME, ŞY.

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The author(s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author(s) in accordance with scientific research methods and academic ethical principles.

### *Editor's Note*

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## REFERENCES

1. Lindgren K. Testing the Health Practices in Pregnancy Questionnaire-II. *J Obstet Gynecol Neonatal Nurs*. 2005;34(4):465-72. doi: [10.1177/0884217505276308](https://doi.org/10.1177/0884217505276308).
2. Kılıç Doğan E, Şen Aytakin M, Kahraman Şimşek A, Alparslan Ö. Anneliği İlk Kez Deneyimleyecek Gebelerin Gözünden Anne Olmak: Bir Metafor Analizi [Becoming a mother from the perspective of pregnant women who will experience motherhood for the first time: A metaphor analysis]. *Pediatr Pract Res*.

- 2025;13(3):69-75. doi: 10.21765/pprjournal.1681830. [Article in Turkish]
3. Türk Ebeler Derneği. Ebelik Mesleğinin Tanımı. Available at : [www.turkebelerderneği.org](http://www.turkebelerderneği.org). Accessed December 12, 2025.
4. Aktaş Reyhan F, Şenlik B. Kadınların Aile Sağlığı Merkezlerindeki Ebelik Hizmetleri İle İlgili Görüşleri [Women's Views on Midwifery Services in Family Health Centers]. KTO Karatay Üniversitesi Sağlık Bilimleri Dergisi. 2025;6(1):30-40. doi: 10.59244/ktokusbd.1595519. [Article in Turkish]
5. Beyaz E, Gökçeoğlu S, Özdemir N. Muş İl Merkezinde Gebelerin Sağlık Uygulama Düzeylerinin Belirlenmesi Determination the Health Practice Levels of Pregnant Women in the Muş City Center]. Van Sag Bil Derg. 2020;13(2):9-16. [Article in Turkish]
6. Deniz M, Bayraktar E. Examining the relationship between positive health behaviors and quality of life in pregnant women, Journal of Health Sciences. 2023;32(2):292-300. doi: 10.34108/eujhs.1187156.
7. Kışlak D, Köse S. Investigation of the effects of distress on health practices in pregnant women. Erzincan University Journal of Science and Technology. 2022;15(3):987-995. doi: 10.18185/erzifbed.1201964.
8. Er S. Gebelikte sağlık uygulamaları ölçeği Türkçe formunun geçerlik ve güvenilirlik çalışması [yüksek lisans tezi], İzmir: Ege Üniversitesi, Sağlık Bilimleri Enstitüsü;2006.
9. Cuschieri S. The STROBE guidelines. Saudi J Anaesth. 2019;13(Suppl 1):S31-S34. doi: 10.4103/sja.SJA\_543\_18.
10. Hacettepe University Institute of Population Studies, Türkiye Population and Health Survey. Available at: [https://hips.hacettepe.edu.tr/tr/2018\\_tnsa\\_analiz\\_ve\\_rapor-56](https://hips.hacettepe.edu.tr/tr/2018_tnsa_analiz_ve_rapor-56). Accessed November 29,2025.
11. Tirkeş D. Gebe kadınların sağlık uygulamaları ve etkileyen faktörlerin incelenmesi [yüksek lisans tezi]. Sivas: Cumhuriyet Üniversitesi, Sağlık Bilimleri Enstitüsü;2012.
12. Çapık A, Sakar T, Apay, SE. Gebelikte Sağlık Uygulamaları İle Duygusal Zeka Arasındaki İlişki [Relationship Between Health Practices and Emotional Intelligence in Pregnancy]. Uluslararası Hakemli Hemşirelik Araştırmaları Dergisi. 2016;6(6):75-88. doi: 10.17371/UHD.2016616569. [Article in Turkish].
13. Pirinççi E, Polat A, Köroğlu A, Kumru S. Bir Üniversite Hastanesinde Doğum Yapan Kadınların Doğum Öncesi Bakım Alma Durumu ve Etkileyen Faktörler [Prenatal Care Conditions of Women Who Delivered in an University Hospital and Influencing Factors]. ADU Tıp Fakültesi Derg. 2010;11(2):1-7. [Article in Turkish].
14. Turgut N, Güldür A, Çakmakçı H, et al. Gebe Okulunda Eğitim Alan Gebelerin Bilgi Düzeyleri Üzerine Bir Araştırma [A Study About Knowledge Level of Pregnants That Educated in Pregnancy School]. Hemşirelik Akademik Araştırma Dergisi. 2017;3(1):1-8. doi: 10.5222/jaren.2017.001. [Article in Turkish].
15. Taş F, Gülpak M, Oktay AA, Demir N. Kadın Doğum ve Çocuk Hastanesinde Doğum Yapan Kadınların Doğum Öncesi Bakım Alma Durumları [Receiving Care Prior to Giving Birth for Women who Gave Birth at The Maternity and Children's Hospital]. KSÜ Tıp Fak Der.2019;14(1):24-30. doi: 10.17517/ksutfd.487188. [Article in Turkish].
16. Yılmaz L, Koruk F, Koruk İ. Şanlıurfa'da Bir Devlet Hastanesinde Doğum Yapmış Kadınların Doğum Öncesi Bakım Hizmetlerini Alma Durumu, Bu Hizmetlerin Niteliği ve Etkileyen Faktörler [The Status of Receiving Antenatal Care Services for Women Who Have Delivered in a State Hospital in Şanlıurfa, the Quality of These Services and Related Factors]. Mersin Univ Sağlık Bilim Derg. 2018;11(2):209-218. doi: 10.26559/mersinsbd.424153. [Article in Turkish].
17. Aygar H, Metintaş S. Bir Kalkınma Göstergesi Olarak Anne Ölümleri [Maternal Mortality as a Development Indicator]. ESTÜDAM Halk Sağlığı Dergisi. 2018;3(3):63-70. [Article in Turkish]
18. Solmaz E, Şahin E. Gebelerin Sağlık Uygulamaları ile Gebelik Stresi İlişkisi ve Etkileyen Faktörlerin İncelenmesi [Examination of the Relationship between Pregnancy Stress and Health Practices in Pregnant Women and the Factors Affecting It]. Etkili Hemşirelik Dergisi. 2024;17(3):362-373. doi: 10.46483/jnef.1516048. [Article in Turkish]
19. Kaya D, Gölbaşı Z. Gebe Kadınların Sağlık Uygulamaları ve Etkileyen Faktörlerin İncelenmesi [Examination of Pregnant Women's Health Practices and Affecting Factors]. Gazi Sağlık Bilimleri Dergisi. 2023; Özel Sayı: 25-32. [Article in Turkish]
20. Yavuz FN, Kaya SP, Kaplan S. Doğum Öncesi Bakım Önerilerinin Ulusal ve Uluslararası Rehberlere Göre Karşılaştırılması [Comparison of Prenatal Care Recommendations Based on National and International Guidelines]. Türkiye Sağlık Araştırmaları Dergisi. 2025; 6(2):9-21. [Article in Turkish]
21. Gök MŞ, Küçük K, Kanbur A. Gebelerde Sağlık Okuryazarlığı ile Sağlık Uygulamaları Arasındaki İlişkinin İncelenmesi [Examination of the Relationship Between Health Literacy and Health Practices of Pregnant Women]. STED. 2023;31(6):409-417. doi: 10.17942/sted.1021910. [Article in Turkish]
22. Bayrak E, Kanbur A. Gebelerde İnternet Yoluyla Karar Alma İle Sağlık Uygulamaları Arasındaki İlişkinin İncelenmesi [Examining the Relationship Between Decision-Making via Internet and Health Practices in Pregnant Women]. İnönü Üniversitesi Sağlık Hizmetleri Meslek Yüksek Okulu Dergisi. 2022;10(1):255-269. doi: 10.33715/inonusaglik.1010546. [Article in Turkish]
23. Balaban S, Özkan H. Gebelikteki Sağlık Uygulamalarının Prenatal Bağlanmayla İlişkisi ve Etkileyen Faktörler [The Correlation of Health Practices in Pregnancy with Prenatal Attachment and Effective Factors]. Göbeklitepe Journal of Medical Science. 2021;4(6):118-128. [Article in Turkish]

# Retrospective Evaluation of Opioid Analgesics Use in Emergency Department: A One-Year Analysis

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## Abstract:

**Objective:** In this study, our aim was to provide data to the literature in terms of both optimal pain control and minimising the side effects of opioids. For this purpose, we retrospectively analysed the opioid model used in the emergency department (ED) of a university hospital.

**Methods:** This is a single-centre, retrospective, and cross-sectional study conducted in the ED of Kütahya Health Sciences University Evliya Çelebi Training and Research Hospital. We retrospectively analysed the electronic medical records of all patients over 18 years of age who were received opioid analgesics in the ED for one year. Data included demographics data (gender, age), diagnosis, type of opioid drug used, hospitalisation and mortality. The study focused on the frequency of opioid use and type of opioid in ED.

**Results:** The study sample included 1392 patients with a mean age of 46.6 years. Of the patients who received opioid analgesics, 45.47% (n=633) were female and 54.53% (n=759) were male. The most common complaint was abdominal pain and 515 patients (37%) received opioids for this reason. The second most common diagnosis was myalgia with 123 patients (8.8%) and the third most common diagnosis was soft tissue injury with 107 patients (7.7%). The most commonly used opioid was fentanyl (n=746, 53.6%). This was followed by tramadol (n=611, 43.9%) and morphine (n=35, 2.5%).

**Conclusion:** Our study found that fentanyl was the most commonly used opioid in the ED, tramadol was preferred for non-traumatic patients such as myalgia, and morphine was rarely used. These results are in line with other data from our country and it has been observed that there is no excessive use of opioids.

**Keywords:** Emergency Department, Opioid Analgesics, Fentanyl, Tramadol, Morphine

Pain is known to be the cause of more than half of patients presenting to EDs [1]. Adequate analgesia for pain is a basic human right, and non-opioid analgesics (non-steroidal anti-inflammatory drugs [NSAIDs] and paracetamol) and opioid analgesics are commonly used in the pharmacological management of pain. Pain management in the ED is sometimes a difficult

problem to solve, and opioid analgesics are very useful in solving this problem. On the one hand, opioid analgesics provide rapid analgesia and immediate relief for the patient, but they can pose a life-threatening risk due to their high addiction profile and side effects [2].

One of the most common problems in pain management in the ED is inadequate analgesia, or

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oligoanalgesia [3]. Although there are many causes of oligoanalgesia, the opiophobia of the physicians is a very important cause. Opioids are analgesics that physicians mostly avoid prescribing because of their addictive potential and side-effect profile, and they are also seen as a common problem in our country [3, 4].

On the other hand, overprescribing of opioid analgesics in the United States of America (USA) and Europe is believed to lead to misuse and abuse of these drugs. It is estimated that opioid overdoses will cause the deaths of 68.630 people in the USA in 2020 [5] and that these figures will continue to rise until 2025 [6]. It has been reported that the contribution of EDs to the amount of opioids used each year is small (approximately 4%), but approximately half of the patients with opioid use disorder are exposed to opioids for the first time with a legal prescription and approximately 20% of these prescriptions are written in the ED [7,8]. In addition, the ongoing opioid crisis in the USA has been defined as one of the most serious and deadly public health crises facing the country [9]. The opioid crisis does not currently exist in our country, but poorly managed opioid using will lead to an increase in opioid use disorder and addiction in the future.

Within this information, the aim of this study was to retrospectively analyse the pattern of opioid used in the ED of a university hospital. The data that we will obtain from this study on the patterns of use of opioid analgesics in our region will contribute to the database, both in terms of providing optimal pain control and minimising the side effects of opioids.

## METHODS

### Study Design, Site and Period

This study is a single-centre, retrospective,

descriptive and cross-sectional data analysis conducted in the Emergency Department of Kütahya Health Sciences University Evliya Çelebi Training and Research Hospital. The study period was set from 1 January 2022 to 1 January 2023. This ED is in a tertiary university hospital that sees about 250.000 patients annually.

### Eligibility Criteria

We retrospectively analysed the electronic medical records of all patients over 18 years of age who were received opioid analgesics in the ED for one year. The exclusion criterion was age under 18 years. Since all patients received opioids over the age of 18 were included in the study, no power analysis was required for sampling.

### Data Collection

The data of the patients who were received opioids in the ED were obtained from the hospital automation system. A data collection form was developed for these patients. Data included demographics data (gender, age), diagnosis, type of opioid drug used, hospitalisation and mortality. The two primary outcome measures were: (i) frequency of opioid use in the ED and (ii) type of opioid used.

### Ethical Considerations

This study was approved by Kütahya Health Sciences University Non-Interventional Clinical Research Ethics Committee (Decision No: 2023/13-26).

### Statistical Analysis

Raw data about the overall patient were analysed using Microsoft Excel. The mean and standard deviation of the continuous variables were given, and

**TABLE 1. Gender of Patients Receiving Opioids**

	Female	Male	P value*
n (%)	633 (45.5%)	759 (54.5%)	
(95% CI)	(43-48)	(52-57)	
Age (years)	52.5±17.6	45.1±16.9	<b>&lt;0.001</b>
(95% CI)	(51.1-53.9)	(45.6-48.1)	<b>(3.8-7.5)</b>

Data are shown as mean±standard deviation or n (%). CI, confidence interval. \*Student t test.

Statistically significant P-value is shown in bold

**TABLE 2. Percentage of Patients Receiving Opioids in Emergency Medicine According to Patient Complaints**

Diagnosis	Total			Female			Male		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Abdominal pain	515	37.0	34.5-39.7	219	42.5	38.3-46.6	296	57.5	53.4-61.7
Myalgia	123	8.8	7.4-10.3	65	52.8	43.9-61.8	58	47.2	38.2-56.1
Soft tissue injury	107	7.7	6.2-9.2	38	35.5	26.2-44.9	69	64.5	55.1-73.8
Headache	86	6.2	4.9-7.4	39	45.3	34.9-55.8	47	54.7	44.2-65.1
Renal colic	70	5.0	4.0-6.2	25	35.7	24.3-47.1	45	64.3	52.9-75.7
Chest pain	46	3.3	2.4-4.3	23	50.0	34.8-65.2	23	50.0	34.8-65.2
Low back pain	45	3.2	2.4-4.2	16	35.6	22.2-51.1	29	64.4	48.9-77.8
Cystitis	43	3.1	2.2-4.0	34	79.1	65.1-90.7	9	20.9	9.3-34.9
Fall injuries	39	2.8	1.9-3.7	23	59.0	43.6-74.4	16	41.0	25.6-56.4
Fracture	37	2.7	1.9-3.5	16	43.2	27.0-59.5	21	56.8	40.5-73.0
Appendicitis	29	2.1	1.4-2.9	12	41.4	24.1-58.6	17	58.6	41.4-75.9
Traffic accident	28	2.0	1.3-2.7	7	25.0	10.7-42.9	21	75.0	57.1-89.3
Gastroenteritis	25	1.8	1.1-2.4	13	52.0	32.0-72.0	12	48.0	28.0-68.0
Gallstone	22	1.6	1.0-2.3	13	59.1	40.9-77.3	9	40.9	22.7-59.1
Pelvic pain	20	1.4	0.9-2.2	20	100.0	100-100	-	-	-
Myocardial infarction	17	1.2	0.6-1.9	6	35.3	11.8-58.8	11	64.7	41.2-88.2
Peptic ulcer	15	1.1	0.6-1.7	7	46.7	20.0-73.3	8	53.3	26.7-80.0
Cholecystitis	12	0.9	0.4-1.4	5	41.7	16.7-66.7	7	58.3	33.3-83.3
Dyspnoea	12	0.9	0.4-1.4	7	58.3	33.3-83.3	5	41.7	16.7-66.7
Ileus	9	0.6	0.3-1.1	4	44.4	11.1-77.8	5	55.6	22.2-88.9
Cerebrovascular diseases	8	0.6	0.2-1.0	4	50.0	12.5-87.5	4	50.0	12.5-87.5
Gastro esophageal reflux	8	0.6	0.2-1.1	7	87.5	62.5-100	1	12.5	0-37.5
Kidney stone	7	0.5	0.2-0.9	2	28.6	0.0-71.4	5	71.4	28.6-100
Pneumothorax	6	0.4	0.1-0.9	3	50.0	16.7-83.3	3	50.0	16.7-83.3
Dorsalgia	6	0.4	0.1-0.8	3	50.0	16.7-83.3	3	50.0	16.7-83.3
Inguinal hernia	6	0.4	0.1-0.9	1	16.7	0-50.0	5	83.3	0-50.0
Shoulder joint dislocation	5	0.4	0.1-0.7	2	40.0	0-80.0	3	60.0	20.0-100
Subarachnoid haemorrhage	5	0.4	0.1-0.7	2	40.0	0-80.0	3	60.0	20.0-100
Cancer	4	0.3	0.1-0.6	2	50.0	0-100	2	50.0	0-100
Pancreatitis	4	0.3	0.1-0.6	2	50.0	0-100	2	50.0	0-100
Haemorrhoids	4	0.3	0.1-0.6	1	25.0	0-75.0	3	75.0	25.0-100
Gunshot injury	3	0.2	0-0.5	1	33.3	0-100	2	66.7	0-100
Gastrointestinal bleeding	3	0.2	0-0.5	3	100.0	100-100	-	-	-
Work accident	3	0.2	0-0.5	1	33.3	0-100	2	66.7	0-100
Heart failure	3	0.2	0-0.5	-	-	-	3	100.0	100-100
Mushroom poisoning	3	0.2	0-0.5	1	33.3	0-100	2	66.7	0-100
Aortic aneurysm	2	0.1	0-0.4	-	-	-	2	100.0	100-100
Atrial fibrillation	2	0.1	0-0.4	1	50.0	0-100	1	50.0	0-100
Dysmenorrhoea	2	0.1	0-0.4	2	100.0	100-100	-	-	-
Embolism and thrombosis	2	0.1	0-0.4	-	-	-	2	100.0	100-100
Cardiac arrest	2	0.1	0-0.4	-	-	-	2	100.0	100-100
Ovarian cysts	2	0.1	0-0.4	2	100.0	100-100	-	-	-
Pulmonary contusion	2	0.1	0-0.4	0	0	0.0-0.0	2	100.0	100-100

CI, confidence interval.

the categorical variables were defined as percentages with 95 % confidence interval. Statistical analysis was performed using SPSS version 20. Kolmogorov-Smirnov normality test was used to assess whether the data were suitable for normal distribution. Student's t-test was used to determine differences in means between groups, and chi-squared test was used to compare categorical variables. A P value less than 0.05 was considered statistically significant.

**RESULTS**

During 12-month period, 248.954 patients were admitted to the ED and 1392 of these patients received opioid analgesics. Of the patients who received opioid analgesics, 45.47 % (n=633) were female and 54.53 % (n=759) were male. The mean age of all patients was 46.59 ± 16.91 years (95% CI: 48.51-50.38), with a minimum age of 19 years and a maximum age of 96 years. The mean age of the females was 52.52±17.58 years (95% CI: 51.14-53.89), while the mean age of the males was 45.13 ± 16.96 years (95% CI: 45.62-48.12) (Table 1).

It was observed that there was a difference between the male and female patients in terms of age (P<0.001) and that the women were older.

The numbers and percentages of patients who used opioids in the ED according to their complaint are shown in Table 2. The most common complaint was abdominal pain and 515 patients (37%, 95% CI: 34.5-39.7) received opioids for this reason. The second most common complaint was myalgia with 123 patients (8.8 %, 95% CI: 7.4-10.3) and the third

most common diagnosis was soft tissue injury with 107 patients (7.7 %, 95% CI: 6.2-9.2).

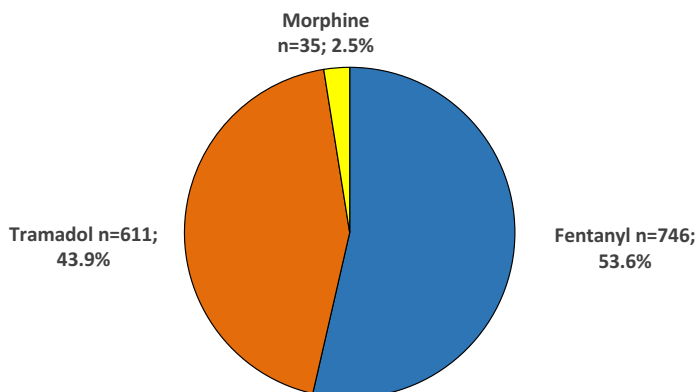
Considering all patients receiving opioids in the ED, the most commonly used opioid was fentanyl (n=746, 53.6%, 95% CI: 50.8-56.1). This was followed by tramadol (n=611, 43.9%, 95% CI: 41.4-46.6) and morphine (n=35, 2.5%, 95% CI: 1.8-3.4) (Figure 1). All drugs were administered intravenously.

Tramadol is most commonly used for myalgia (n=88, 71.5%), soft tissue injury (n=60, 56.1%), headache (n=46, 53.5%), low back pain (n=38, 84.4%), cystitis (n=27, 62.8%), gastroenteritis (n=15, 60.0%), peptic ulcer (n=8, 53.3%), gastro esophageal reflux (n=8, 100%), dorsalgia (n=6, 100%), work accident (n=2, 66.7%) and dysmenorrhea (n=2, 100%). Morphine was most commonly used for myocardial infarction (n=17, 100%) and fracture (n=8, 21.6%). Fentanyl was the first opioid used for other diagnoses (Table 3).

Of the 1392 patients who used opioids, 304 (21.8 %) were inpatients, including 136 (44.7 %) females and 168 (55.3 %) males. The number of outpatients was 1088 (78.2 %), of which 297 (27.3 %) were female and 591 (72.7 %) were male.

Among inpatients, 205 received fentanyl, 78 received tramadol and 21 received morphine. Among outpatients, 541 received fentanyl, 533 received tramadol and 14 received morphine. There was a difference in the use of fentanyl, tramadol and morphine between inpatients and outpatients. (X<sup>2</sup>;73.232, P<0.0001). It was observed that fentanyl was used more frequently than tramadol in inpatients (Figure 2, Table 4).

Among 1392 patients who received opioids, 4

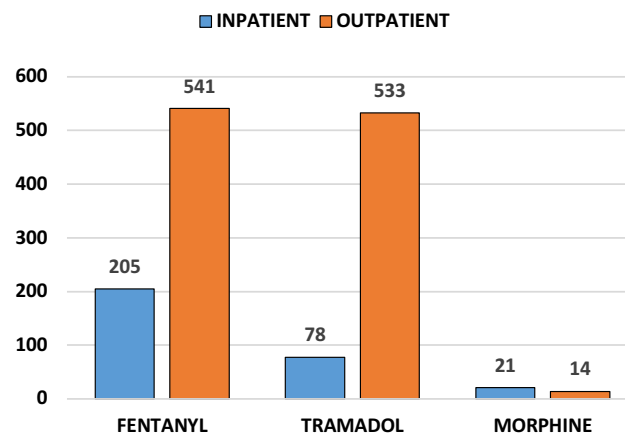


**FIGURE 1.** Percentages of opioid drugs used in the emergency department.

**TABLE 3. Rates of Opioid Drug Use According to Patient Complaints**

Diagnosis	Fentanyl			Tramadol			Morphine		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Abdominal pain	289	56.1	51.7-60.2	226	43.9	39.8-48.3	-	-	-
Myalgia	35	28.5	20.3-36.6	88	71.5	63.4-79.7	-	-	-
Soft tissue injury	46	43.0	33.6-53.3	60	56.1	45.8-65.4	1	0.9	0-3.7
Headache	40	46.5	34.9-57.0	46	53.5	43.0-65.1	-	-	-
Renal colic	53	75.7	65.7-85.7	17	24.3	14.3-34.3	-	-	-
Chest pain	31	67.4	54.3-80.4	15	32.6	19.6-45.7	-	-	-
Low back pain	7	15.6	6.7-26.7	38	84.4	73.3-93.3	-	-	-
Cystitis	16	37.2	23.3-53.5	27	62.8	46.5-76.7	-	-	-
Fall injuries	20	51.3	35.9-66.7	19	48.7	33.3-64.1	-	-	-
Fracture	19	51.4	35.1-67.6	10	27.0	13.5-40.5	8	21.6	8.1-35.1
Appendicitis	27	93.1	82.8-100	2	6.9	0-17.2	-	-	-
Traffic accident	20	71.4	53.6-85.7	4	14.3	3.6-28.6	4	14.3	3.6-28.6
Gastroenteritis	10	40.0	20.0-60.0	15	60.0	40.0-80.0	-	-	-
Gallstone	19	86.4	72.7-100	3	13.6	0-27.3	-	-	-
Pelvic pain	19	95.0	85.0-100	1	5.0	0-15.0	-	-	-
Myocardial infarction	-	-	-	-	-	-	17	100	100-100
Peptic ulcer	7	46.7	20.0-73.3	8	53.3	26.7-80.0	-	-	-
Cholecystitis	10	83.3	58.3-100	2	16.7	0-41.7	-	-	-
Dyspnoea	10	83.3	58.3-100	2	16.7	0-41.7	-	-	-
Ileus	7	77.8	44.4-100	2	22.2	0-55.68	-	-	-
Cerebrovascular diseases	8	100	100-100	-	-	-	-	-	-
Gastro esophageal reflux	-	-	-	8	100	100-100	-	-	-
Kidney stone	7	100	100-100	-	-	-	-	-	-
Pneumothorax	6	100	100-100	-	-	-	-	-	-
Dorsalgia	-	-	-	6	100	100-100	-	-	-
Inguinal hernia	4	66.7	33.3-100	2	33.3	0-66.7	-	-	-
Shoulder joint dislocation	2	40.0	0-80.0	-	-	-	3	60.0	20.0-100
Subarachnoid haemorrhage	5	100	100-100	-	-	-	-	-	-
Cancer	2	50.0	0-100	-	-	-	2	50.0	0.0-100
Pancreatitis	3	75.0	25.0-100	1	25.5	0-75.0	-	-	-
Haemorrhoids	1	25.0	0.0-75.0	3	75.0	25.0-100	-	-	-
Gunshot injury	3	100	100-100	-	-	-	-	-	-
Gastrointestinal bleeding	3	100	100-100	-	-	-	-	-	-
Work accident	1	33.3	0-100	2	66.7	0-100	-	-	-
Heart failure	2	66.7	0-100	1	33.3	0-100	-	-	-
Mushroom poisoning	2	66.7	0-100	1	33.3	0-100	-	-	-
Aortic aneurysm	2	100	100-100	-	-	-	-	-	-
Atrial fibrillation	2	100	100-100	-	-	-	-	-	-
Dysmenorrhoea	-	-	-	2	100.0	100-100	-	-	-
Embolism and thrombosis	2	100	100-100	-	-	-	-	-	-
Cardiac arrest	2	100	100-100	-	-	-	-	-	-
Ovarian cysts	2	100	100-100	-	-	-	-	-	-
Pulmonary contusion	2	100	100-100	-	-	-	-	-	-
<b>Total</b>	<b>746</b>			<b>611</b>			<b>35</b>		

CI, confidence interval.



**FIGURE 2.** Number of inpatient and outpatient and types of opioid medication.

patients were hospitalised and died. Two of the patients had cancer, one had an aortic aneurysm and one was experiencing chest pain. All of the patients were around 70 years old and none of their causes of death were opioid-related. All 4 of these patients used fentanyl.

**DISCUSSION**

This single-centre, retrospective study in a tertiary care hospital found that fentanyl was the most commonly used opioid in the ED, tramadol was preferred in non-traumatic patients, and morphine was rarely used. Abdominal pain, myalgia and soft tissue injury were the most common reasons for opioid use in the ED, respectively.

Pain is the most common reason for ED consultations, affecting 40-70% of patients [10]. Adequate analgesia is one of the most important goals of pain management. Non-opioid analgesics (NSAIDs and paracetamol) and opioid analgesics are the main pharmacological treatments for pain. Codeine, tramadol, morphine, methadone and fentanyl are

commonly used opioid analgesics in ED. Sevcik *et al.* reported that morphine (35.8%) was the most commonly used drug in patients admitted to the ED for trauma, followed by oxycodone (39.6%), codeine (19.3%), hydromorphone (12.7%), fentanyl (12.3%) and tramadol (3%) [11]. In Türkiye, 59.2% of patients were reported to have received fentanyl, 51.3% tramadol, 0.4% meperidine and 1.56% morphine in a study analysing patients presenting to ED with pain and receiving opioid analgesics [12]. In our study, the most commonly used opioid was fentanyl (53.6%), followed by tramadol (43.9%) and morphine (2.5%). The difference between these studies may be explained by age, gender and diagnostic differences between the patient populations.

Fentanyl is a synthetic opioid that is a full mu-receptor agonist and produces analgesia similar to that of morphine, but to a greater extent [13]. Fentanyl is currently one of the most commonly used opioids for pain control, sedation and anaesthesia by intravenous, transdermal and transmucosal routes [14]. The use of fentanyl has become widespread in trauma patients due to its rapid onset of analgesia, minimal effect on

**TABLE 4.** Number of Inpatient and Outpatient and Types of Opioid Medication

	Opioid						X <sup>2</sup> P value*
	Fentanyl		Tramadol		Morphine		
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI	
<b>Inpatient</b>	205 (27.5)	24.1-30.6	78 (12.8)	10.1-15.4	21 (60)	42.9-77.1	73.232
<b>Outpatient</b>	541 (72.5)	69.4-75.9	533 (87.2)	84.6-89.9	14 (40)	22.9-57.1	<b>&lt;0.0001</b>

CI, confidence interval. \*chi-squared test. Statistically significant P-value is shown in bold.

blood pressure and reduced potential for nausea and vomiting compared with morphine [15]. Tramadol is a centrally acting analgesic and a synthetic opioid, with a structure similar to that of codeine. Although tramadol has less analgesic effect than morphine, it is preferred because it is safer. Compared to other opioid analgesics, tramadol is considered safe as it does not cause respiratory depression or dependence. Tramadol is mainly used in the treatment of muscle pain, joint pain and wound pain [16].

In our study, opioids were mostly administered to patients with abdominal pain (n=515). Of these patients, 289 received fentanyl and 226 received tramadol. Acute abdominal pain is observed in around 8% of patients presenting to the ED [17]. Adequate analgesia can be administered to these patients and opioid analgesics can be used for severe pain [18]. Fentanyl has been reported to be a safe and effective drug for providing analgesia to ED patients with abdominal pain [19]. These data support the results of our study. On the other hand, tramadol is also preferred in acute abdominal pain. Oğuztürk *et al.* evaluated the efficacy of early analgesic administration in patients presenting to the ED with acute abdominal pain, as well as its interaction with diagnosis. They found that tramadol and paracetamol provided effective analgesia without leading to diagnostic error [20]. Another study reported that fentanyl was the most commonly used opioid in acute abdominal pain, followed by tramadol [12]. Similarly, tramadol was the second most commonly used opioid in abdominal pain in our study.

Myalgia may occur as a symptom of various diseases, including overuse and strain of the muscles, infections, trauma, metabolic disorders, inflammatory disorders and nutritional disorders. NSAIDs are often used to treat myalgia in EDs, if these are not sufficient, opioid drugs may be used [21]. In our study, myalgia was the second most common reason for visiting the ED, after abdominal pain. The third most common reason was soft tissue injury. Tramadol was found to be most commonly used for myalgia (71.5%), soft tissue injury (56.1%), headache (53.5%), low back pain (84.4%), cystitis (62.8%), gastroenteritis (60.0%), peptic ulcer (53.3%), gastro esophageal reflux (100%), dorsalgia (100%), work accident (66.7%) and dysmenorrhea (100%) in our study. Fentanyl was the second most commonly used opioid in these

complaints. In general, tramadol is considered safer than other opioids for treating moderate pain in cases where NSAIDs have been ineffective, because it has fewer respiratory depressant and addictive effects.

In our study, morphine was administered to a total of 35 patients, primarily those experiencing myocardial infarction, fractures, traffic accidents and cancer. However, contrary to the results of our study, there are studies reporting that morphine is the first opioid used for pain relief in EDs [22, 23]. Studies have shown that emergency physicians in Türkiye rarely use morphine or meperidine. Instead, they prefer tramadol for patients with severe pain. They also prefer fentanyl for conditions such as abdominal pain and pneumothorax, as it does not cause respiratory depression and has low anti-inflammatory capacity [12]. Similarly, in our study, meperidine was not preferred and morphine was rarely used.

Although there are many causes of oligoanalgesia, the opiophobia of the physicians is a very important cause. Opioids are analgesics that physicians mostly avoid prescribing because of their addictive potential and side-effect profile, and they are also seen as a common problem in our country [3, 4]. Our study found that fentanyl was the most preferred opioid, suggesting that physicians in the ED where the study was conducted are willing to use strong opioids when necessary.

In recent years, fentanyl and its derivatives have caused addiction and death to increase dramatically in many parts of the world, particularly in North America and Europe. Although there is currently no opioid crisis in our country, the illegal use of fentanyl derivatives has been detected. Fentanyl and its derivatives are considered an imminent threat to our country [24].

### Strengths and Limitations

This study has several notable strengths. The relatively large sample size of 1392 patients collected over a one-year period enhances the representativeness of the findings and increases statistical reliability. The study reflects real-world clinical practice in a tertiary emergency department and provides practical and generalisable data on opioid use patterns. A comprehensive overview of opioid prescribing practices, including drug type, clinical indication, and patient demographics, offers a multidimensional perspective on

ED opioid utilisation. Finally, the findings are particularly relevant in the current context of global concerns regarding opioid overuse, as this study demonstrates that prescribing practices in this setting appear to be within appropriate clinical boundaries.

However, this study has several limitations. Firstly, pre- and post-procedure pain scores were not evaluated. Additionally, sufficient data on the analgesic efficacy and potential side effects of opioids could not be obtained. Furthermore, there is a lack of information regarding patients' comorbidities and the concomitant use of non-opioid analgesics, which may influence opioid selection and dosage. Future studies with a broader scope that include pain scores, side-effect profiles and concomitant factors would yield more clinically meaningful and generalisable results.

## CONCLUSION

In conclusion, our study found that fentanyl was the most commonly used opioid for abdominal pain, renal colic and chest pain in the ED, tramadol was preferred for non-traumatic patients such as myalgia, and morphine was rarely used. Although our study found fentanyl to be the most commonly used opioid, overuse and overprescription of fentanyl in ED is not currently observed in our country. However, given that fentanyl use in EDs has increased over time, it is important to raise awareness of this issue.

### *Ethics Approval and Consent to Participate*

This study was approved by the Kütahya Health Sciences University Non-Interventional Clinical Research Ethics Committee (Decision No.: 2023/13-26 and dated 28.11.2023). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Informed consent was waived because of the retrospective nature of the study and the analysis used anonymous clinical data.

### *Data Availability*

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on

request from the corresponding author, upon reasonable request.

### *Authors' Contribution*

Study Conception: YT, MK; Study Design: YT, MK; Supervision: YT, MK; Funding: YT, MK; Materials: N/A; Data Collection and/or Processing: YT, MK; Statistical Analysis and/or Data Interpretation: YT, MK; Literature Review: YT, MK; Manuscript Preparation: YT; and Critical Review: YT, MK.

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The author(s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author(s) in accordance with scientific research methods and academic ethical principles.

### *Editor's Note*

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## REFERENCES

1. Cordell WH, Keene KK, Giles BK, Jones JB, Jones JH, Brizendine EJ. The high prevalence of pain in emergency medical care. *Am J Emerg Med.* 2002;20(3):165-169. doi: [10.1053/ajem.2002.32643](https://doi.org/10.1053/ajem.2002.32643).
2. Jerant A, Agnoli A, Franks P. Satisfaction with Health Care Among Prescription Opioid Recipients. *J Am Board Fam Med.* 2020;33(1):34-41. doi: [10.3122/jabfm.2020.01.190090](https://doi.org/10.3122/jabfm.2020.01.190090).
3. Bertrand S, Meynet G, Taffè P, et al. Opiophobia in Emergency

- Department Healthcare Providers: A Survey in Western Switzerland. *J Clin Med.* 2021;10(7):1353. doi: [10.3390/jcm10071353](https://doi.org/10.3390/jcm10071353).
4. Baldemir R, Akçaboy EY, Noyan Ö, Akçaboy ZN, Baydar M, Çelik Ş. Doktorların opioid kullanımı ve opiofobiye yaklaşımlarının değerlendirilmesi: Bir eğitim ve araştırma hastanesinden anket sonuçları [An assessment of physicians attitudes toward opioid usage and opiophobia: Results of a survey from a training and research hospital]. *Agri.* 2019;31(1):23-31. doi: [10.5505/agri.2018.03411](https://doi.org/10.5505/agri.2018.03411). [Article in Turkish]
5. Drug overdose death rates. Bethesda (MD): National Institute on Drug Abuse; 2023. <https://nida.nih.gov/research-topics/trends-statistics/overdose-death-rates> (accessed 2023 Nov. 23).
6. Chen Q, Larochelle MR, Weaver DT, et al. Prevention of prescription opioid misuse and projected overdose deaths in the United States. *JAMA Netw Open* 2019;2:e187621. doi: [10.1001/jamanetworkopen.2018.7621](https://doi.org/10.1001/jamanetworkopen.2018.7621).
7. Daoust R, Paquet J, Émond M, et al; Quantity of Opioids for Acute Pain and Limit Unused Medication (OPUM) group on behalf of the Network of Canadian Emergency Researchers. Opioid prescribing requirements to minimize unused medications after an emergency department visit for acute pain: a prospective cohort study. *CMAJ.* 2024;196(25):E866-E874. doi: [10.1503/cmaj.231640](https://doi.org/10.1503/cmaj.231640).
8. Butler MM, Ancona RM, Beauchamp GA, et al. Emergency Department Prescription Opioids as an Initial Exposure Preceding Addiction. *Ann Emerg Med.* 2016;68(2):202-208. doi: [10.1016/j.annemergmed.2015.11.033](https://doi.org/10.1016/j.annemergmed.2015.11.033).
9. Gleber R, Vilke GM, Castillo EM, Brennan J, Oyama L, Coyne CJ. Trends in emergency physician opioid prescribing practices during the United States opioid crisis. *Am J Emerg Med.* 2020;38(4):735-740. doi: [10.1016/j.ajem.2019.06.011](https://doi.org/10.1016/j.ajem.2019.06.011).
10. Chang HY, Daubresse M, Kruszewski SP, Alexander GC. Prevalence and treatment of pain in EDs in the United States, 2000 to 2010. *Am J Emerg Med.* 2014;32(5):421-431. doi: [10.1016/j.ajem.2014.01.015](https://doi.org/10.1016/j.ajem.2014.01.015).
11. Sevcik B, Lobay K, Luu H, et al. Analgesic Use Among Adults with a Trauma-Related Emergency Department Visit: A Retrospective Cohort Study from Alberta, Canada. *Pain Ther.* 2023;12(4):1039-1053. doi: [10.1007/s40122-023-00521-1](https://doi.org/10.1007/s40122-023-00521-1).
12. Cabioğlu KS. Acil Tıp Kliniğine Ağrı Şikayeti İle Başvurup Opioid Analjezik İlaç Kullanılan Hastaların Geriye Dönük İncelenmesi [Retrospective Analysis of Patients Presenting to the Emergency Medicine Clinic with Pain Complaints and Using Opioid Analgesic Drugs]. Thesis. Bakırköy Dr. Sadi Konuk Eğitim ve Araştırma Hastanesi, Sağlık Bilimleri Üniversitesi, 2017. [Article in Turkish]
13. Comer SD, Cahill CM. Fentanyl: Receptor pharmacology, abuse potential, and implications for treatment. *Neurosci Biobehav Rev.* 2019;106:49-57. doi: [10.1016/j.neubiorev.2018.12.005](https://doi.org/10.1016/j.neubiorev.2018.12.005).
14. Bird HE, Huhn AS, Dunn KE. Fentanyl absorption, distribution, metabolism, and excretion: narrative review and clinical significance related to illicitly manufactured fentanyl. *J Addict Med.* 2023;17(5):503-508. doi: [10.1097/ADM.0000000000001185](https://doi.org/10.1097/ADM.0000000000001185).
15. Wenderoth BR, Kaneda ET, Amini A, Amini R, Patanwala AE. Morphine versus fentanyl for pain due to traumatic injury in the emergency department. *J Trauma Nurs.* 2013;20(1):10-5. doi: [10.1097/JTN.0b013e31828660b5](https://doi.org/10.1097/JTN.0b013e31828660b5).
16. Subedi M, Bajaj S, Kumar MS, Yc M. An overview of tramadol and its usage in pain management and future perspective. *Biomed Pharmacother.* 2019;111:443-451. doi: [10.1016/j.biopha.2018.12.085](https://doi.org/10.1016/j.biopha.2018.12.085).
17. Wu RR, Adjei-Poku MN, Kelz RR, et al. Trends in visits, imaging, and diagnosis for emergency department abdominal pain presentations in the United States, 2007-2019. *Acad Emerg Med.* 2025;32(1):20-31. doi: [10.1111/acem.15017](https://doi.org/10.1111/acem.15017).
18. Falch C, Vicente D, Häberle H, et al. Treatment of acute abdominal pain in the emergency room: a systematic review of the literature. *Eur J Pain.* 2014;18(7):902-13. doi: [10.1002/j.1532-2149.2014.00456.x](https://doi.org/10.1002/j.1532-2149.2014.00456.x).
19. Bartfield JM, Flint RD, McErlean M, Broderick J. Nebulized fentanyl for relief of abdominal pain. *Acad Emerg Med.* 2003;10(3):215-218. doi: [10.1111/j.1553-2712.2003.tb01993.x](https://doi.org/10.1111/j.1553-2712.2003.tb01993.x).
20. Oguzturk H, Ozgur D, Turtay MG, et al. Tramadol or paracetamol do not effect the diagnostic accuracy of acute abdominal pain with significant pain relief - a prospective, randomized, placebo controlled double blind study. *Eur Rev Med Pharmacol Sci.* 2012;16(14):1983-1988.
21. Friedman BW, Irizarry E, Feliciano C, et al. A randomized controlled trial of oxycodone/acetaminophen versus acetaminophen alone for emergency department patients with musculoskeletal pain refractory to ibuprofen. *Acad Emerg Med.* 2021;28(8):859-865. doi: [10.1111/acem.14231](https://doi.org/10.1111/acem.14231).
22. Lvovschi VE, Carrouel F, Hermann K, Lapostolle F, Joly LM, Tavolacci MP. Severe pain management in the emergency department: patient pathway as a new factor associated with IV morphine prescription. *Front Public Health.* 2024;12:1352833. doi: [10.3389/fpubh.2024.1352833](https://doi.org/10.3389/fpubh.2024.1352833).
23. Fabbri A, Voza A, Riccardi A, Serra S, Iaco F; Study and Research Center of the Italian Society of Emergency Medicine (SIMEU). The Pain Management of Trauma Patients in the Emergency Department. *J Clin Med.* 2023;12(9):3289. doi: [10.3390/jcm12093289](https://doi.org/10.3390/jcm12093289).
24. Türkiye Cumhuriyeti İçişleri Bakanlığı Emniyet Genel Müdürlüğü Narkotik Suçlarla Mücadele Başkanlığı: Türkiye Uyuşturucu Raporu Eğilimler ve Gelişmeler [Republic of Türkiye Ministry of Internal Affairs General Directorate of Security Department of Combating Narcotic Crimes: Türkiye Drug Report Trends and Developments]. Ankara, 2024. [Article in Turkish].

# The Relationship Between Smartphone Overuse, Affective Lability, Depression, and Anxiety Levels in University Students

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## Abstract:

**Objective:** This study aimed to investigate the relationship between smartphone overuse and affective lability, depression, and anxiety levels among university students.

**Methods:** A total of 216 university students were included in the study. Participants were recruited via online platforms. To collect data, sociodemographic data forms, the Affective Lability Scale-18 (ALS-18), the Patient Health Questionnaire-9 (PHQ-9), the Generalized Anxiety Disorder-7 (GAD-7), and the Smartphone Overuse Screening Scale (SOSS) were used.

**Results:** The mean age of the 216 university students who participated in the study was 21±1.23 years; 141 (65.28%) were male, 75 (34.72%) were female; 6 (2.78%) were only children, while 210 (97.22%) had siblings. Fourteen (6.48%) had parents living separately, and 202 (93.52%) had parents living together. Spearman correlation analysis revealed a significant positive correlation between the total score of the SOSS and the total score, as well as all subdimensions of the ALS-18, and the total scores of the PHQ-9 and GAD-7. Wilcoxon test showed no significant difference in total SOSS scores between male and female groups, between only children and those with siblings, or between those who had received psychological treatment and those who had not. The Wilcoxon test indicated that participants with siblings scored significantly higher in the ALS-18 Depression/Elevation subscale compared to those who were only children. Regression analysis results showed that among the independent variables, only the ALS-18 anger variable had a significant effect on smartphone overuse.

**Conclusion:** Smartphone overuse is associated with affective lability, anxiety levels, and depressive symptoms. Therefore, there is a need for appropriate health education programs and interventions to improve the mental health of university students.

**Keywords:** Smartphone, Anxiety, Depression, Affective Lability

Nowadays, smartphone use plays a significant role in both our professional and social lives. Smartphone overuse, characterized by increasing duration of use and behaviors such as the urge to use the phone immediately upon waking, has

become a contemporary topic of discussion due to its physical and cognitive indicators [1]. Smartphone overuse, regarded as a type of behavioral overuse and studied by researchers, is not yet explicitly defined in the Diagnostic and Statistical Manual of Mental Dis-

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orders (DSM-V). However, the inclusion of "gambling disorder" and "internet gaming disorder" in DSM-V, which may share similar patterns with smartphone overuse, is considered a positive step for research in this field [2, 3, 4].

A bidirectional relationship has been shown between smartphone overuse and depressive symptoms [5]. There is evidence suggesting that smartphone overuse may be a cause of depression and anxiety [6]. A review of the literature reveals findings indicating a relationship between smartphone overuse and negative emotional states such as anxiety and depression [7-9]. However, the underlying mechanisms between smartphone overuse and depression and anxiety still require further investigation. Strong associations have been identified between smartphone overuse and psychiatric disorders such as depression, anxiety, bipolar disorder, dependent personality disorder, compulsive personality disorder, and somatization. Additionally, it has been reported that depression, anxiety, and bipolar disorders significantly predict smartphone overuse [10]. Previous studies have suggested that emotion dysregulation may be related to the development and maintenance of various psychiatric disorders and maladaptive behaviors [11]. A key aspect of emotion dysregulation is abnormal frequency, intensity, and breadth of affective fluctuations [12]. Affective lability is present in many psychiatric conditions and is a core feature of several forms of psychopathology, including bipolar disorder and borderline personality disorder [13-15].

This study investigated the relationship between excessive smartphone use—which negatively affects individuals' work and social lives—and affective lability, depression, and anxiety levels. Studies directly examining the relationship between smartphone overuse and affective lability among university students in Turkey are limited. Therefore, our study aims to fill this gap in the literature.

## Research Hypotheses

H1: Students with smartphone overuse will have higher affective lability scores.

H2: Students with smartphone overuse will have higher depression scores.

H3: Students with smartphone overuse will have higher anxiety scores.

## METHODS

### Study Design and Sample

The study used a convenience sampling method, which limits the generalizability of the results. Participants volunteered through announcements made through online platforms (social media groups and email lists of university student communities). Participation in the study was entirely voluntary, and no incentives were provided. A total of 250 students completed the survey, and after excluding incomplete forms, 216 participants (86.4% response rate) were included in the analyses.

Data were collected using a sociodemographic data form, the Affective Lability Scale-18 (ALS-18), the Patient Health Questionnaire-9 (PHQ-9), the Generalized Anxiety Disorder-7 (GAD-7), and the Smartphone Overuse Screening Scale (SOSS). In the analysis, psychological variables (affective lability, depression, and anxiety), as well as family structure (presence of a sibling) and family income level, were initially included in the model as potential socioeconomic confounding variables. The purpose of including these variables is to control for possible demographic factors that may influence smartphone overuse.

The study was initiated with the approval of the Alanya Alaaddin Keykubat University Faculty of Medicine Clinical Research Ethics Committee dated 11.09.2024 and numbered 20-07.

### Data Collection Tools

#### Sociodemographic Data Form

A form developed by the researchers to collect data on participants' age, gender, etc.

#### Affective Lability Scale (ALS-18)

Developed by Oliver and Simons (2004) [17], ALS-18 is an 18-item Likert-type self-report questionnaire that assesses affective lability across three dimensions: perceived changes in emotions and related cognition, physiological changes, and behavioral changes. Each item is rated on a 4-point scale ranging from "not at all characteristic" to "very characteristic" (0–3). The scale measures three types of affective lability: Anxiety/Depression (AD), Depression/Elevation (DE), and Anger. Higher scores indicate greater

affective lability. ALS-18 has been shown to have good internal consistency and appropriate test-retest reliability. Test-retest analysis demonstrated temporal stability over 30 days, with reliability estimates ranging from 0.56 to 0.79 for women and 0.48 to 0.86 for men. The Turkish validity and reliability study was conducted by Doğan and Şenormancı, with Cronbach's alpha internal consistency coefficients found to be  $\alpha=0.92$  for both the AD and DE groups [18].

### Patient Health Questionnaire-9 (PHQ-9)

The PHQ-9 is a 9-item scale developed based on DSM-IV criteria for depression. It was selected for this study due to its brevity compared to other depression scales, its established validity and reliability, and its widespread use by healthcare professionals in international publications for depression screening. The severity of depressive symptoms assessed using the PHQ-9 is scored between 0–27 points. In the Turkish adaptation study, the internal consistency coefficient was reported as 0.84, indicating that the scale is a valid and reliable measurement tool. According to this scale, scores of 1–4 indicate minimal depression, 5–9 mild, 10–14 moderate, 15–19 moderately severe, and 20–27 severe depression [19]. Furthermore, previous studies have suggested a cut-off score of 15 for depression risk [20]. Accordingly, in the current study, the cut-off score for depression was set at 15 based on literature findings.

### Generalized Anxiety Disorder-7 (GAD-7)

The GAD-7 is a scale constructed based on the DSM-IV-TR criteria for generalized anxiety disorder (GAD) [21]. The scale consists of seven items, with a total score ranging from 0 to 21. In the Turkish validity and reliability study, the internal consistency coefficient was calculated as 0.85 [22]. While the original version of the scale identified a cut-off score of 10 as the threshold for a probable diagnosis of GAD, the Turkish adaptation determined the cut-off to be 8. Therefore, in this study, a cut-off score of 8 was used for anxiety.

### Smartphone Overuse Screening Scale (SOSS)

The scale comprises subfactors including preoccupation, loss of control, craving, insight, excessive use, and neglect of other areas. Its Turkish validity and

reliability were established by Kuru *et al.* [23]. In that study, the Cronbach's alpha for the total score was reported as 0.93, and the test-retest reliability coefficient was 0.79. The items of the scale are evaluated based on the last month and rated on a 4-point Likert scale ranging from 0 to 3 (never, sometimes, often, always).

### Statistical Analysis

Statistical analyses, data management, visualization, and reporting processes were carried out using R version 4.4.2 [16]. Descriptive statistics were calculated; numerical data were summarized using mean±standard deviation or median (min–max), and categorical data were presented as n (%). Normality was assessed using the Shapiro-Wilk test. For normally distributed data, t-tests and ANOVA were used; for non-normally distributed data, Wilcoxon and

**TABLE 1. Demographic Characteristics of the Participants (n=216)**

Demographic Characteristics	Value
Age (years)	
18-30	21.0±1.23
Gender	
Female	75 (34.72%)
Male	141 (65.28%)
Sibling existence	
Yes	210 (97.22%)
No	6 (2.78%)
Are the parents married or divorced?	
Divorced	14 (6.48%)
Married	202 (93.52%)
Monthly income of mother and father (minimum wage)	
1	63 (29.17%)
2-3	96 (44.44%)
4-6	27 (12.50%)
7-12	14 (6.48%)
13 and above	16 (7.41%)
Psychological treatment history	
Yes	14 (6.48%)
No	202 (93.52%)

Data are shown as mean±standard deviation or n (%).

Kruskal-Wallis tests were applied. For categorical variables, the chi-square test or Fisher's exact test (when cell counts were low) was used. In correlation analyses, Pearson was applied for normally distributed data, while Spearman and Kendall Tau were used for non-parametric data. Linear regression analyses were performed to model the relationships between variables, and logistic regression models were applied for binary categorical dependent variables.

## RESULTS

The mean age of the 216 university students participating in the study was  $21 \pm 1.23$  years. Of these, 141 (65.28%) were male and 75 (34.72%) were female; 6 (2.78%) were only children, while 210 (97.22%) had siblings; 14 (6.48%) had parents who were living separately, and 202 (93.52%) had parents living together (Table 1). Detailed descriptive analysis of the numerical data is provided in Table 2.

Spearman correlation analysis showed a statistically significant positive correlation between the total SOSS score and the ALS-18 total score ( $r=0.504$ ,  $P<0.001$ ), ALS-18 Depression Elevation ( $r=0.393$ ,  $P<0.05$ ), PHQ-9 total score ( $r=0.513$ ,  $P<0.001$ ), and GAD-7 total score ( $r=0.433$ ,  $P<0.001$ ). Furthermore, a significant positive correlation was found between

the SOSS Insight subscale and GAD-7 ( $r=0.342$ ,  $P<0.001$ ).

The Wilcoxon test showed that there were no significant differences in SOSS Total Score between the female and male groups ( $W = 5650.5$ ,  $P=0.407$ ), between the only child and having a sibling ( $W = 774$ ,  $P=0.342$ ), between the groups receiving psychological treatment and those not receiving psychological treatment ( $W=1316.5$ ,  $P=0.668$ ), and between the groups with divorced and married parents ( $W=1551$ ,  $P=0.546$ ) (Table 3).

The Wilcoxon test revealed no significant differences in GAD-7 total score ( $W=1560.5$ ,  $P=0.518$ ), PHQ-9 total score ( $W=1470.5$ ,  $P=0.804$ ), or ALS-18 total score ( $W=1601$ ,  $P=0.409$ ), and all subscales, between participants whose parents live together and those whose parents live separately.

The Wilcoxon test revealed a significant difference between groups with a sibling and those with a single child across all scales, except for the ALS-18 depression elevation subscale ( $W=310.5$ ,  $P=0.034$ ), and significantly higher affective variability in those with a sibling. However, the very small number of only child participants ( $n=6$ ) necessitates a cautious and limited interpretation of this result (Table 3).

The Wilcoxon test showed significant differences between male and female participants in the ALS-18 total score ( $W=6151.5$ ,  $P=0.048$ ), ALS-18 Anxiety &

**TABLE 2. Detailed Descriptive Analysis of Numerical Data (n=216)**

Variables	Median (Min-Max)	Mean±SD
GAD-7 Total points	8.0 (0-21)	8.98±5.12
PHQ-9 Total points	10.0 (0-27)	11.05±5.86
ALS-18 Anxiety/Depression	13.0 (5-21)	12.27±4.05
ALS-18 Depression/Elevation	21.0 (8-32)	20.57±5.88
ALS-18 Anger	11.0 (5-20)	11.37±3.91
ALS-18 Total points	46.0 (18-72)	44.21±12.26
Preoccupation factor	10.0 (0-26)	10.55±5.55
Loss of control factor	4.0 (0-12)	3.99±2.70
Craving factor	3.0 (0-9)	3.34±2.27
Insight factor	3.0 (0-9)	3.11±2.49
Overuse factor	1.0 (0-6)	1.51±1.52
SOSS Total points	21.5 (0-66)	23.48±13.73

GAD-7, Generalized Anxiety Disorder-7; PHQ-9, Patient Health Questionnaire-9; ALS-18, Affective Liability Scale-18; SOSS, Smartphone Overuse Screening Scale; Max, maximum; Min, minimum; SD, standard deviation

Depression subscale ( $W=6157$ ,  $P=0.046$ ), and ALS-18 Depression Elevation subscale ( $W=6481.5$ ,  $P=0.006$ ), with females exhibiting significantly higher affective lability. No significant gender differences were found in ALS-18 Anger, PHQ-9 total score, GAD-7 total score, or SOSS total and subscale scores (Table 3).

The Fisher's exact test showed a significant relationship between a history of psychological treatment and the presence of siblings ( $P=0.004$ ). The Wilcoxon test also revealed a significant difference in the ALS-18 Anxiety & Depression subscale between participants with and without a history of psychological treatment ( $W=969$ ,  $P=0.048$ ), suggesting that those with a history of psychological treatment had significantly higher affective lability.

Regression analysis revealed that the model had an explanatory power of  $R^2 = 0.353$  and Adjusted  $R^2 = 0.234$ . The overall model fit was significant,  $F(9, 49) = 2.97$ ,  $P=0.0067$ . Assumption checks (linearity, normality, and multicollinearity) indicated no violations.

In the linear regression analysis, only ALS-18 Anger was found to be statistically significant ( $P=0.008$ ,  $\beta=0.449$ ). As ALS-18 Anger scores increased, SOSS total scores also increased significantly (Table 4). The correlation heatmap is presented in Figure 1.

## DISCUSSION

This study investigated the relationship between excessive smartphone use and psychological variables among university students. In the study, the presence of siblings and income level were also included in the model; however, these variables are not theoretically considered primary determinants of smartphone overuse. Therefore, they were evaluated solely to control for potential confounding effects. Our findings indicate that these demographic variables did not make a significant contribution to the model. Thus, it can be concluded that psychological factors (affective lability, depression, and anxiety) primarily emerge as the main

**TABLE 3. Relationships Between Demographic Variables and Scale Scores**

Demographic variables	Scale Scores	GAD-7	PHQ-9	ALS-18	ALS-18	ALS-18	ALS-18	SOSS
		T	T	A/D	D/E	Anger	T	T
		P-value <sup>a</sup>						
<b>Gender</b>	Female (n=141)	0.126	0.282	<b>0.046*</b>	<b>0.006**</b>	0.843	<b>0.048*</b>	0.407
	Male (n=75)	—	—	—	—	—	—	—
<b>Sibling existence</b>	None (n=6)	0.783	0.968	0.588	<b>0.034*</b>	0.469	0.235	0.342
	Present (n=210)	—	—	—	—	—	—	—
<b>Family unity</b>	Separated (n=14)	0.518	0.804	0.206	0.959	0.294	0.409	0.546
	Together (n=202)	—	—	—	—	—	—	—
<b>Psychological treatment</b>	None (n=202)	0.225	0.239	<b>0.048*</b>	0.993	0.461	0.403	0.668
	Present (n=14)	—	—	—	—	—	—	—

GAD-7, Generalized Anxiety Disorder-7; PHQ-9, Patient Health Questionnaire-9; ALS-18, Affective Lability Scale-18; SOSS, Smartphone Overuse Screening Scale; T, total points, A/D, anxiety/depression; D/E, depression/elevation.

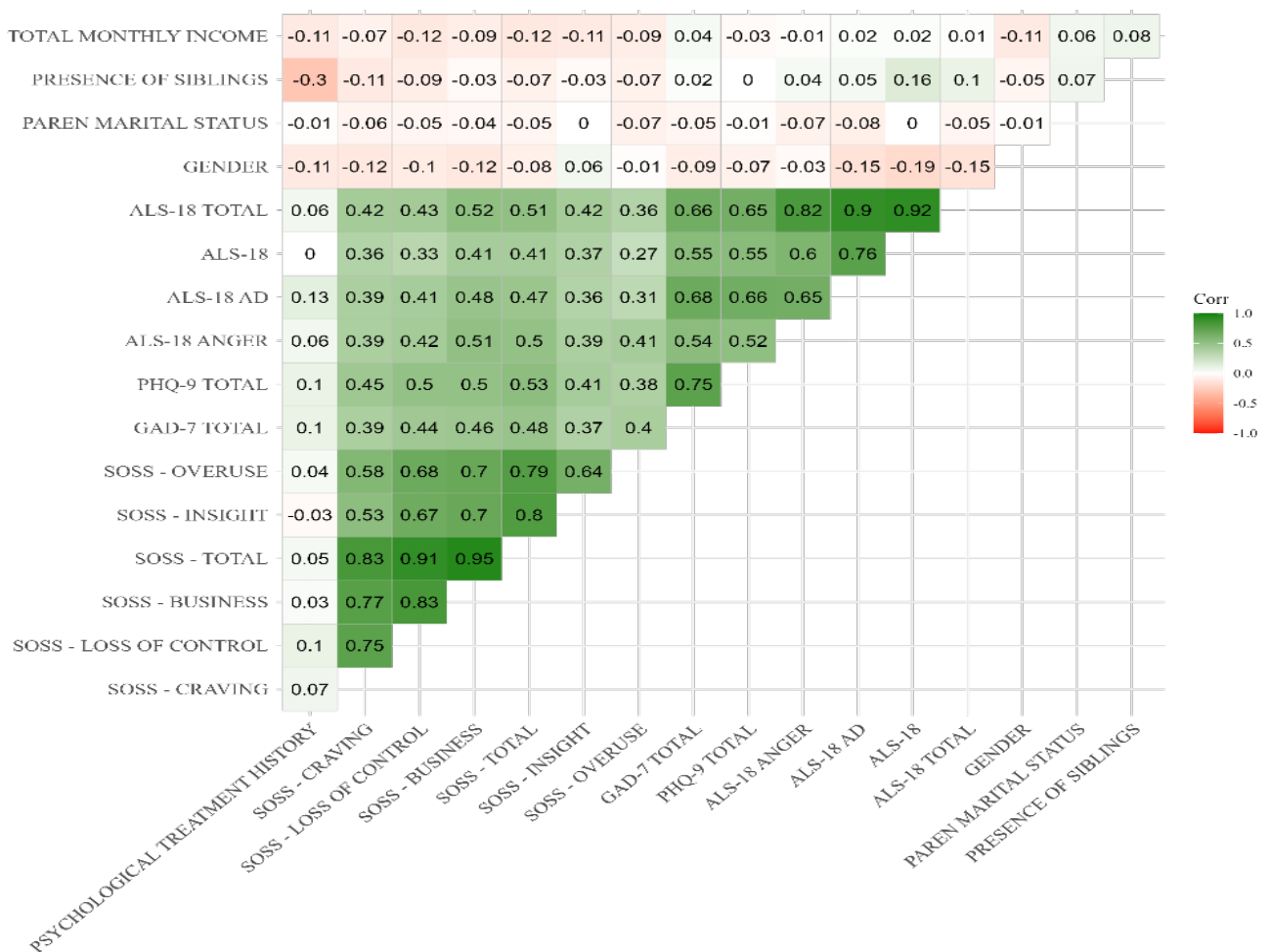
<sup>a</sup>Wilcoxon Test (Mann–Whitney U). Significance: \* $P<0.05$ ; \*\* $P<0.01$ . Statistically significant P-values are shown in bold.

**TABLE 4. SOSS Total Points Regression Analysis with All Relevant Data**

Variable	B	Beta	t	P-value	95% Confidence Interval
Constant	-1.221	—	-0.051	0.959	(-49.117, 46.675)
ALS-18 Anxiety/Depression	-0.575	-0.103	-0.53	0.598	(-2.753, 1.604)
ALS-18 Depression/Elevation	0.185	0.051	0.277	0.783	(-1.160, 1.530)
ALS-18 Anger	<b>1.871</b>	<b>0.449</b>	<b>2.771</b>	<b>0.008</b>	<b>(0.514, 3.227)</b>
PHQ-9 Total points	-0.118	-0.024	-0.172	0.865	(-1.504, 1.267)
GAD-7 Total points	0.958	0.26	1.503	0.139	(-0.323, 2.239)
Sibling existence	9.135	0.072	0.43	0.669	(-33.524, 51.794)
Are the parents married or divorced?	-5.73	-0.088	-0.64	0.525	(-23.731, 12.272)
Monthly Income of mother and father	-1.766	-0.13	-1.028	0.309	(-5.217, 1.686)
Psychological treatment history	-4.536	-0.084	-0.635	0.528	(-18.882, 9.809)

GAD-7, Generalized Anxiety Disorder-7; PHQ-9, Patient Health Questionnaire-9; ALS-18, Affective Liability Scale-18; SOSS, Smartphone Overuse Screening Scale

R<sup>2</sup>: 0.353, Adjusted R Square: 0.234, F(9.49)=2.97, P=0.0067. Statistically significant P-value is shown in bold.



**FIGURE 1. Correlation heatmap.**

predictors of smartphone overuse. The findings indicate a statistically significant positive correlation between smartphone overuse and anxiety, depression, and affective lability. These results are consistent with previous research and support the notion that smartphone overuse may have adverse effects on individuals' psychological health [24]. Additionally, our findings are consistent with studies demonstrating that emotion regulation difficulties significantly predict smartphone overuse [25]. In the present study, the Wilcoxon test showed no significant difference between smartphone overuse and variables such as gender, only-child status, or history of psychological treatment. This result suggests that gender differences reported in some previous studies were not observed in this sample [3, 26]. Nevertheless, given that female participants exhibited higher affective lability scores on the ALS-18 subscales, this result warrants cautious interpretation. The fact that female participants had higher depression and anxiety scores is consistent with similar findings in the literature [27, 28]. These findings indicate that SOSS scores are primarily associated with psychological and behavioral characteristics of individuals, while showing no direct link to factors such as family structure.

Moreover, participants with siblings had significantly higher scores in the ALS-18 Depression Elevation subscale. Additionally, individuals with a history of psychological treatment scored significantly higher in the ALS-18 Anxiety & Depression subscale, suggesting that individuals requiring psychological support may be more vulnerable in terms of affective lability.

The results of the regression analysis revealed that among the independent variables, only the ALS-18 Anger subscale had a statistically significant effect on smartphone overuse. As the level of anger increased, smartphone overuse also increased. This finding suggests that individuals who struggle with anger regulation may be more prone to developing digital addictions. The relationship between anger and impulsivity is also a topic emphasized in the literature [29]. Therefore, intervention programs targeting smartphone overuse should focus on improving emotional regulation strategies.

### Strengths and Limitations

Although this study provides valuable insights

into the relationship between excessive smartphone use and psychological variables, several limitations should be noted. The use of convenience sampling and recruitment of participants via online voluntary enrollment limits the representativeness and generalizability of the findings. The cross-sectional design of the study precludes causal inferences between variables; longitudinal studies are needed to provide stronger evidence regarding the causal direction of these relationships. Furthermore, the sample consisted solely of university students, and the number of only-child participants was very small ( $n=6$ ), necessitating cautious interpretation of the results. Finally, the influence of cultural and socioeconomic factors on excessive smartphone use warrants more detailed investigation.

### CONCLUSION

This study demonstrates that excessive smartphone use is closely associated with individuals' psychological well-being, whereas no direct relationship was observed with factors such as family structure. The findings provide practical implications for understanding university students' digital habits in the context of mental health. For educators, monitoring students' smartphone use and identifying those at risk of overuse can facilitate the implementation of digital literacy and time management training. Such interventions may support students' academic performance and psychological well-being. For clinicians, including psychologists and counselors, interventions can be developed to manage mood variability in students, along with individual or group therapies aimed at reducing symptoms of depression and anxiety. From a university policy perspective, integrating campus digital usage policies with mental health programs can promote preventive strategies that enhance students' psychological well-being. This holistic approach may help mitigate the negative effects of excessive digital use and improve overall quality of life. Overall, these findings offer concrete recommendations for both academic and clinical practice, highlighting the importance of interventions that address university students' digital habits and mental health in an integrated manner.

### *Ethics Approval and Consent to Participate*

This study was approved by the Alanya Alaaddin

Keykubat University Faculty of Medicine Clinical Research Ethics Committee (Decision No: ALKÜ-KAEK-2024/20-07; date: 11.09.2024). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Written informed consent was obtained from all individual participants included in the study.

#### *Data Availability*

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

#### *Authors' Contribution*

Study Conception: VD, GKS; Study Design: VD, GKS; Supervision: VD; Funding: VD, GKS; Materials: VD; Data Collection and/or Processing: VD, GKS; Statistical Analysis and/or Data Interpretation: VD; Literature Review: VD, GKS; Manuscript Preparation: VD; and Critical Review: VD.

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#### *Generative Artificial Intelligence Statement*

The all content of the study was produced by the author(s) in accordance with scientific research methods and academic ethical principles. During the preparation of this work, the authors used ChatGPT to improve language and readability. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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## REFERENCES

1. Dula A, Güler Ş. Akıllı Telefon Bağımlılığı Üzerinde Dijital Sosyal Baskının Rolünü Keşfetmek [Exploring the Role of Digital Social Pressure on Smartphone Addiction]. *Cyprus Turkish Journal of Psychiatry & Psychology*. 2022;4(4):306-314. doi: [10.35365/ctjpp.22.4.01](https://doi.org/10.35365/ctjpp.22.4.01). [Article in Turkish]
2. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders: DSM-5*. 5th ed. Washington, DC: APA; 2013.
3. Kwon M, Kim DJ, Cho H, Yang S. The smartphone addiction scale: development and validation of a short version for adolescents. *PLoS One*. 2013;8(12):e83558. doi: [10.1371/journal.pone.0083558](https://doi.org/10.1371/journal.pone.0083558).
4. Tam PG. Problematic internet use in youth: An outline and overview for health professionals. *Australian Clinical Psychologist*. 2017;2(1):1-14.
5. Shi X, Wang A, Zhu Y. Longitudinal associations among smartphone addiction, loneliness, and depressive symptoms in college students: Disentangling between- And within-person associations. *Addict Behav*. 2023;142:107676. doi: [10.1016/j.adbeh.2023.107676](https://doi.org/10.1016/j.adbeh.2023.107676).
6. Alhassan AA, Alqadhib EM, Taha NW, Alahmari RA, Salam M, Almutairi AF. The relationship between addiction to smartphone usage and depression among adults: a cross sectional study. *BMC Psychiatry*. 2018;18(1):148. doi: [10.1186/s12888-018-1745-4](https://doi.org/10.1186/s12888-018-1745-4).
7. Ithnain N, Ghazali SE, Jaafar N. Relationship between smartphone addiction with anxiety and depression among undergraduate students in Malaysia. *Int J Health Sci Res*. 2018;8(1):163-171.
8. Kim SG, Park J, Kim HT, Pan Z, Lee Y, McIntyre RS. The relationship between smartphone addiction and symptoms of depression, anxiety, and attention-deficit/hyperactivity in South Korean adolescents. *Ann Gen Psychiatry*. 2019;18:1. doi: [10.1186/s12991-019-0224-8](https://doi.org/10.1186/s12991-019-0224-8).
9. Matar Boumosleh J, Jaalouk D. Depression, anxiety, and smartphone addiction in university students- A cross sectional study. *PLoS One*. 2017;12(8):e0182239. doi: [10.1371/journal.pone.0182239](https://doi.org/10.1371/journal.pone.0182239).
10. Alavi SS, Ghanizadeh M, Farahani M, Jannatifard F, Esmaili Alamuti S, Mohammadi MR. Addictive Use of Smartphones and Mental Disorders in University Students. *Iran J Psychiatry*. 2020;15(2):96-104.
11. Svaldi J, Griepenstroh J, Tuschen-Caffier B, Ehring T. Emotion regulation deficits in eating disorders: a marker of eating pathology or general psychopathology? *Psychiatry Res*. 2012;197(1-2):103-11. doi: [10.1016/j.psychres.2011.11.009](https://doi.org/10.1016/j.psychres.2011.11.009).
12. Thompson RJ, Berenbaum H, Bredemeier K. Cross-sectional and longitudinal relations between affective instability and depression. *J Affect Disord*. 2011;130(1-2):53-59. doi: [10.1016/j.jad.2010.09.021](https://doi.org/10.1016/j.jad.2010.09.021).

13. Benazzi F, Akiskal HS. A downscaled practical measure of mood lability as a screening tool for bipolar II. *J Affect Disord.* 2005;84(2-3):225-232. doi: 10.1016/j.jad.2003.09.010.
14. Aminoff SR, Jensen J, Lagerberg TV, et al. An association between affective lability and executive functioning in bipolar disorder. *Psychiatry Res.* 2012;198(1):58-61. doi: 10.1016/j.psychres.2011.12.044.
15. Reich DB, Zanarini MC, Fitzmaurice G. Affective lability in bipolar disorder and borderline personality disorder. *Compr Psychiatry.* 2012;53(3):230-237. doi: 10.1016/j.comppsy.2011.04.003.
16. R Core Team. R: A language and environment for statistical computing (Version 4.4.2) [Computer software]. R Foundation for Statistical Computing, Vienna, Austria. 2024. <https://www.R-project.org/>
17. Oliver MNI, Simons JS. The affective lability scales: Development of a short-form measure. *Pers Individ Dif.* 2004;37(6):1279-1288. doi: 10.1016/j.paid.2003.12.013.
18. Doğan V, Şenormancı Ö. Validity and Reliability of the Affective Lability Scale-18 (ALS-18) Turkish Form in the Non-Clinical Group. *Turk Psikiyatri Derg.* 2025;36:18. doi: 10.5080/u27329.
19. Sarı YE, Kokoglu B, Balcioglu H, Bilge U, Çolak E, Ün-lüoğlu İ. Turkish reliability of the patient health questionnaire-9. *Biomedical Research.* 2016(Special Issue):S460-S462.
20. Rossi R, Succi V, Pacitti F, et al. Mental Health Outcomes Among Frontline and Second-Line Health Care Workers During the Coronavirus Disease 2019 (COVID-19) Pandemic in Italy. *JAMA Netw Open.* 2020;3(5):e2010185. doi: 10.1001/jamanetworkopen.2020.10185.
21. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med.* 2006;166(10):1092-1097. doi: 10.1001/archinte.166.10.1092.
22. Konkan R, Senormancı Ö, Güçlü O, Aydın E, Sungur M.Z. Generalized Anxiety Disorder-7 (GAD-7) Turkish version validity and reliability. *Noropsikiyatri Ars.* 2013;50(1):53-58. doi: 10.4274/npa.y6308.
23. Kuru T, Uymaz P, Cömertoğlu S, Çelenk S. Turkish Validity and Reliability of the Smartphone Overuse Screening Questionnaire. *Addicta: The Turkish Journal on Addictions.* 2022;9(3):320-327. doi: 10.5152/ADDICTA.2022.22053.
24. Elhai JD, Levine JC, Alghraibeh AM, Alafnan AA, Aldrai-weesh AA, Hall BJ. Fear of missing out: Testing relationships with negative affectivity, online social engagement, and problematic smartphone use. *Comput Human Behav.* 2018;89:289-298. doi: 10.1016/j.chb.2018.08.020.
25. Sevi Tok ES, Güzel HŞ. Akıllı telefon bağımlılığı, bağlanma ve duygu düzenlemenin ilişkisi: Mizaç ve karakter özelliklerinin aracı rolü [The relationship between smartphone addiction, attachment, and emotion regulation]. *Klinik Psikoloji Dergisi.* 2020;4(1):48-62. doi: 10.5455/kpd.26024438m000020. [Article in Turkish]
26. Aktan AK, Kutlay Ö. Tıp Fakültesi Öğrencilerinde Akıllı Telefon Bağımlılığı, Depresyon Ve Anksiyete Arasındaki İlişki [The Relationship Between Smartphone Addiction, Depression, And Anxiety in Faculty of Medicine Students]. *Acıbadem Univ. Sağlık Bilim. Derg.* 2021; 12(2): 176-182. doi: 10.31067/acusaglik.852109. [Article in Turkish]
27. Aliyev V. Effects of Pharmacotherapy on Cognitive Functions in Major Depressive Disorder. [Medical Thesis]. Ankara Üniversitesi, Türkiye. 2020.
28. Antep Z, Kocadağ ZA, Sur H. Evaluation of Depression, Anxiety and Stress Levels of Healthcare Workers During the Covid-19 Pandemic in Turkey. *Nobel Med.* 2023;19(3):166-173.
29. Ramirez JM, Andreu JM. Aggression, and some related psychological constructs (anger, hostility, and impulsivity); some comments from a research project. *Neurosci Biobehav Rev.* 2006;30(3):276-291. doi: 10.1016/j.neubiorev.2005.04.015.

# Delayed Bilateral Chylothorax After Cholecystectomy Without Thoracic Intervention: A Rare Case Report

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## Abstract:

Chylothorax is an uncommon cause of pleural effusion, most frequently associated with thoracic trauma, malignancy, or congenital lymphatic disorders. Development of chylothorax following abdominal surgery without direct thoracic intervention is rare. We report a 77-year-old female who developed delayed bilateral pleural effusions after cholecystectomy and was subsequently diagnosed with chylothorax. The clinical course was notable for an intervening enterocutaneous fistula. Diagnosis was confirmed by pleural fluid analysis demonstrating markedly elevated triglyceride levels. The patient was successfully managed with conservative treatment, including pleural drainage and total parenteral nutrition, without the need for surgical intervention. This case highlights a rare delayed presentation of chylothorax following abdominal surgery and underscores the importance of considering lymphatic complications in complex postoperative courses.

**Keywords:** Chylothorax, Pleural Effusion, Pulmonary, Cholecystectomy

Chylothorax is a rare cause of pleural effusion, most commonly resulting from thoracic duct injury, malignancy, or congenital lymphatic abnormalities [1-3]. It is typically encountered following thoracic trauma or surgical interventions involving the mediastinum [2]. In contrast, the development of chylothorax after abdominal surgery, particularly in the absence of direct thoracic manipulation, is exceedingly uncommon and poses a diagnostic challenge [4].

Delayed presentation of chylothorax may further obscure its recognition, especially when accompanied by complex postoperative complications [4]. Awareness of atypical etiologies and clinical courses is therefore essential to avoid misdiagnosis and unnecessary interventions. Herein, we present a rare case of delayed bilateral chylothorax following

cholecystectomy without thoracic intervention, highlighting possible pathophysiological mechanisms and the effectiveness of conservative management.

## CASE PRESENTATION

A 77-year-old female patient underwent a cholecystectomy approximately 18 months before admission. Approximately 12 months after surgery, she developed persistent purulent discharge from the subxiphoid port site. Further evaluation revealed an enterocutaneous fistula. Surgical repair was recommended; however, the patient declined operative intervention and was therefore managed conservatively.

During follow-up at an external center, a right-sided pleural effusion was detected and drained using

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a pleurocan catheter. No biochemical analysis of the pleural fluid was performed at that time, representing a significant limitation in the initial evaluation. Following drainage, imaging demonstrated resolution of the right-sided effusion; however, a new pleural effusion subsequently developed in the left hemithorax. Due to progressive dyspnea and increasing pleural fluid, the patient was referred to our clinic. At that stage, the etiology of the effusion was unclear, and malignancy or postoperative complications were initially considered.

The patient had no known history of chronic pulmonary disease. Serial chest radiographs demonstrated progressive accumulation of pleural fluid in the left hemithorax. Diagnostic thoracentesis yielded a yellow and turbid pleural fluid (Figure 1), which remained turbid after centrifugation.



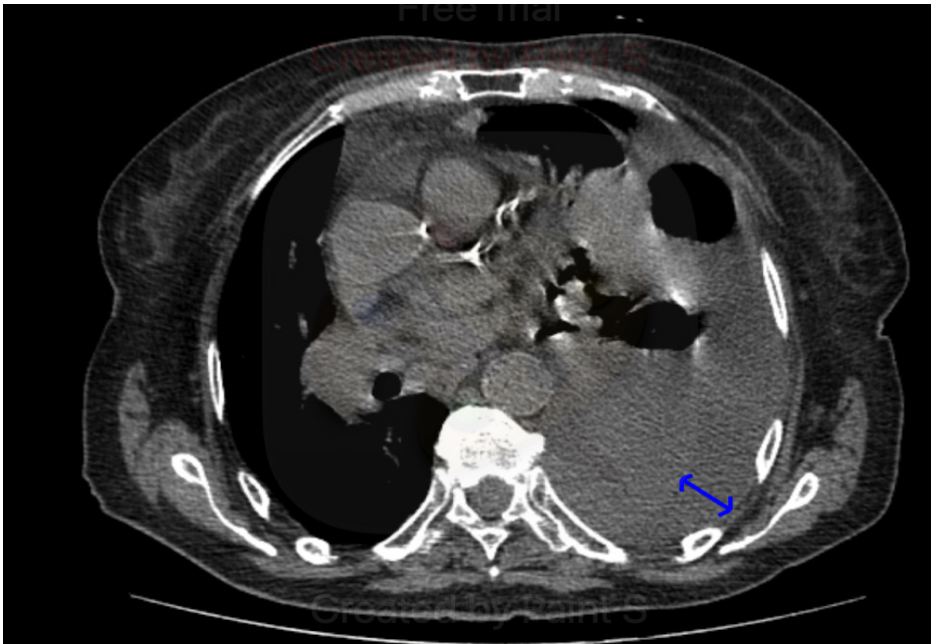
**FIGURE 1.** Fluid obtained from thoracentesis.

Biochemical analysis of the pleural fluid revealed triglyceride levels of 697 mg/dL, glucose 171 mg/dL, lactate dehydrogenase 195 IU/L, protein 4.44 g/dL, lipase <10.5 mmol/L, and amylase 38 mmol/L. Based on Light's criteria, the effusion was classified as exudative [5]. Microbiological cultures were negative. A diagnosis of chylothorax was established, and tube thoracostomy was performed. Before the tube thoracostomy, thoracic computed tomography was performed. Thoracic computed tomography showed no radiological evidence of malignancy. The radiology report described a pleural effusion in the posterior aspect of the left hemithorax, measuring up to 81.5 mm at its widest point, with associated reduction in lung aeration. Ground-glass opacities were present in both lungs, more pronounced on the left side, along with an area of atelectasis involving the lingular segment of the left lung. Passive atelectasis of the left lower lobe secondary to the pleural effusion was also noted (Figure 2). In addition, peribronchial wall thickening was observed. The right lower lobe demonstrated subsegmental atelectasis and pleuroparenchymal band formation.

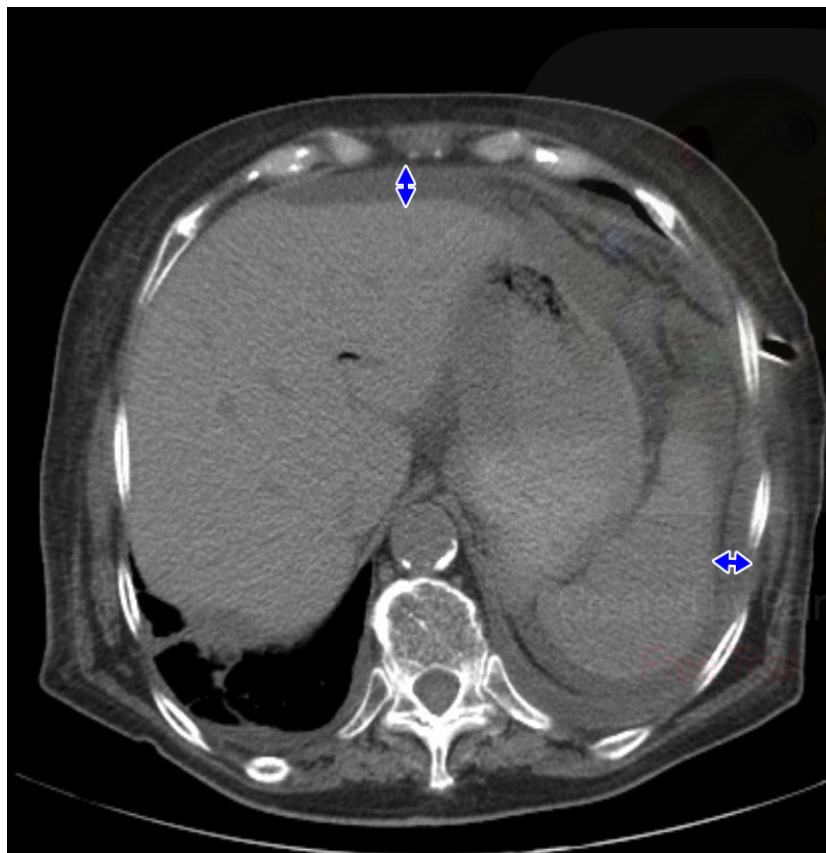
Oral intake was discontinued, and total parenteral nutrition was initiated for nine days. As pleural drainage decreased and the fluid became serous, the chest tube was replaced with a Heimlich valve [6]. Multidisciplinary consultations with general surgery and gynecology were conducted to evaluate potential intra-abdominal etiologies. During follow-up, no recurrence of pleural effusion was observed. Cytology obtained from the pleural effusion fluid revealed suspicious findings related to malignancy.

Abdominal computed tomography performed during follow-up after fluid drainage revealed no findings suggestive of malignancy. According to the radiology report, fluid-density collections were observed in the perihepatic, perisplenic, and perigastric regions, as well as along both paracolic gutters and in the lower abdominal quadrant (Figure 3). Gas images were noted within the intrahepatic bile ducts and the common bile duct. The gallbladder was not visualized, consistent with prior cholecystectomy, and metallic suture materials were observed in the surgical bed.

After this, imaging was performed, and pathological examination of the specimens obtained from both the intra-abdominal fluid and the intestinal



**FIGURE 2.** Thoracic computed tomography revealing pleural effusion (blue double-sided arrow) at the posterior aspect of the left hemithorax.



**FIGURE 3.** Abdominal computed tomography reveals a fluid-density collection (blue double-sided arrows) in the abdominal region (particularly in perihepatic, perisplenic and perigastric regions).

mesentery, sampled due to suspicion of peritoneal implants in the setting of a previously operated abdomen, revealed benign findings.

## DISCUSSION

Chylothorax is a rare etiology of pleural effusion and is most commonly associated with thoracic duct injury, malignancy, or congenital lymphatic abnormalities. In recent years, chylothorax following thoracoabdominal surgery has been increasingly reported; however, its occurrence after cholecystectomy without direct thoracic manipulation remains exceptionally rare [1, 3, 4].

In the present case, the diagnosis of chylothorax was supported by markedly elevated pleural fluid triglyceride levels and persistent turbidity after centrifugation. The absence of biochemical analysis of the initial right-sided pleural effusion constitutes a notable limitation; nevertheless, the subsequent left-sided effusion fulfilled established diagnostic criteria for chylothorax.

The delayed and bilateral nature of the pleural effusions, in conjunction with the presence of an enterocutaneous fistula, suggests a possible postoperative lymphatic disruption. Potential mechanisms include injury to the retroperitoneal lymphatic network or anatomical variations of the cisterna chyli [7]. Subdiaphragmatic lymphatic leakage with secondary transdiaphragmatic passage of chyle into the pleural space may also contribute. Inflammatory processes associated with enterocutaneous fistula formation may further alter lymphatic flow and lead to aberrant lymphatic drainage. Although a direct causal relationship cannot be definitively established, the temporal sequence makes this association clinically plausible.

Conservative management is considered the first-line approach in non-malignant chylothorax. In this case, cessation of oral intake, total parenteral nutrition, and adequate pleural drainage resulted in complete resolution without the need for surgical intervention. This outcome highlights the importance of individualized treatment strategies and multidisciplinary evaluation in selected patients.

## CONCLUSION

Chylothorax should be considered in the differential diagnosis of recurrent pleural effusions, particularly when pleural fluid is turbid and associated with elevated triglyceride levels. Although most cases are related to thoracic trauma, malignancy, or congenital lymphatic disorders, rare delayed presentations may occur following abdominal surgical procedures such as cholecystectomy. Among the possible etiologies of the fluid accumulation, lymphatic injury related to prior cholecystectomy could be considered. However, a review of the patient's previous medical records, as well as subsequent follow-up data from the general surgery and gastroenterology outpatient clinics, did not reveal any findings to support this hypothesis.

This case emphasizes the value of thorough pleural fluid analysis, careful assessment of postoperative complications, and the effectiveness of conservative management in appropriately selected patients. Awareness of atypical postoperative lymphatic complications may facilitate earlier diagnosis and prevent unnecessary diagnostic or therapeutic interventions.

### *Ethics Approval and Consent to Participate*

As this is a single-patient case report that does not include identifiable personal information, ethics committee approval was not required. Written informed consent was obtained from the patient for publication of this case and accompanying images.

### *Data Availability*

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

### *Authors' Contribution*

Study Conception: IÇ; Study Design: IÇ, MY; Supervision: IÇ, MY; Funding: IÇ, MY; Materials: IÇ; Data Collection and/or Processing: IÇ, MY; Statistical Analysis and/or Data Interpretation: IÇ, MY; Literature Review: IÇ; Manuscript Preparation: IÇ; and Critical Review: IÇ.

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### *Generative Artificial Intelligence Statement*

The author (s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author (s) in accordance with scientific research methods and academic ethical principles.

### *Editor's Note*

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## REFERENCES

1. McGrath EE, Blades Z, Anderson PB. Chylothorax: aetiology, diagnosis and therapeutic options. *Respir Med.* 2010;104(1):1-8. doi: 10.1016/j.rmed.2009.08.010.
2. Williams E, Hanna N, Mussari B, Chung W. Thoracic duct embolization via chest tube for a patient with postoperative traumatic chylothorax. *Can J Surg.* 2021;64(6):E650-E653. doi: 10.1503/cjs.022119.
3. Bhatnagar M, Fisher A, Ramsaroop S, Carter A, Pippard B. Chylothorax: pathophysiology, diagnosis, and management-a comprehensive review. *J Thorac Dis.* 2024;16(2):1645-1661. doi: 10.21037/jtd-23-1636.
4. Riley LE, Ataya A. Clinical approach and review of causes of a chylothorax. *Respir Med.* 2019;157:7-13. doi: 10.1016/j.rmed.2019.08.014.
5. Zoia A, Slater LA, Heller J, Connolly DJ, Church DB. A new approach to pleural effusion in cats: markers for distinguishing transudates from exudates. *J Feline Med Surg.* 2009;11(10):847-855. doi: 10.1016/j.jfms.2009.04.005.
6. Şanlı M, Elma B, Işık AF, Tunçözgür B, Elbeyli L. Uzamış hava kaçağı ve inatçı plevral boşluk yönetiminde Heimlich valfinin etkinliği [Efficiency of Heimlich valve in the management of prolonged air leaks and persistent pleural space]. *Türk Göğüs Kalp Damar Cerrahisi Dergisi.* 2014;22(1):112-117. doi: 10.5606/tgkdc.dergisi.2014.8479. [Article in Turkish]
7. Griffo S, De Luca G, Stassano P. Chylothorax after abdominal surgery. *Gen Thorac Cardiovasc Surg.* 2010;58(3):159-162. doi: 10.1007/s11748-009-0503-4.