

## The Relationship Between Treatment Compliance and Emotional Well-Being in Individuals with Type 2 Diabetes: A Hierarchical Multiple Regression Analysis

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### ABSTRACT

**Objective:** This study investigated the relationship between treatment compliance and emotional well-being in individuals with type 2 diabetes and identified predictors of compliance. **Method:** A descriptive, cross-sectional study was conducted with the Type 2 diabetic patients. Data were collected using a personal information form, Patient Compliance Scale in Type 2 Diabetes Mellitus Treatment, and Emotional Well-Being Scale. Analyses included descriptive statistics, regression, and Pearson correlation, with significance set at  $p<0.05$ . **Results:** The study was completed with 651 patients. The mean compliance score was  $80.64\pm12.16$ , and the mean emotional well-being score was  $47.92\pm11.94$ . Hierarchical regression showed that negative and positive emotional well-being, doing exercise, diagnosis period, oral antidiabetic use, hospitalization, body mass index, gender and age explained 32.8% of the variance in treatment compliance (Durbin-Watson:1.973,  $F=9.973$ ,  $p<0.001$ ,  $R=0.594$ ,  $R^2=0.353$ , Adjusted  $R^2=0.328$ ). **Conclusion:** Treatment compliance in individuals with type 2 diabetes is multidimensional and is influenced by several factors, with emotional well-being being one of the significant associated factors.

**Key words:** Type 2 Diabetes, treatment compliance, emotional well-being, nursing

## Tip 2 Diyabet Tanılı Bireylerde Tedaviye Uyum ve Duygusal İyi Oluş Arasındaki İlişki: Hiyerarşik Çoklu Regresyon Analizi

### ÖZ

**Amaç:** Bu çalışma, tip 2 diyabetli bireylerde tedaviye uyum ile duygusal iyilik hali arasındaki ilişkiyi araştırmayı ve uyumun yordayıcılarını belirlemeyi amaçlamıştır. **Yöntem:** Tip 2 diyabet tanılı hastalarla tanımlayıcı, kesitsel bir çalışma yürütülmüştür. Veriler, kişisel bilgi formu, Tip 2 Diyabet Mellitus Tedavisinde Hasta Uyum Ölçeği ve Duygusal İyilik Hali Ölçeği kullanılarak toplanmıştır. Analizler, tanımlayıcı istatistikler, regresyon ve Pearson korelasyonunu içermekte olup, anlamlılık düzeyi  $p<0,05$  olarak belirlenmiştir. **Bulgular:** Çalışma 651 hasta ile tamamlanmıştır. Ortalama uyum puanı  $80,64\pm12,16$  ve ortalama duygusal iyilik hali puanı  $47,92\pm11,94$ 'tür. Hiyerarşik regresyon, negatif ve pozitif duygusal iyilik hali, egzersiz yapma, tanı dönemi, oral antidiyabetik kullanımı, hastaneye yatış, vücut kitle indeksi, cinsiyet ve yaşın tedaviye uyumdaki varyansın %32,8'sini açıkladığını göstermiştir (Durbin-Watson:1.973,  $F=9.973$ ,  $p<0.001$ ,  $R=0.594$ ,  $R^2=0.353$ , Düzeltilmiş  $R^2=0.328$ ). **Sonuç:** Tip 2 diyabetli bireylerde tedaviye uyum çok boyutlu bir yapıya sahip olup çeşitli faktörlerden etkilenmektedir. Bu faktörler arasında duygusal iyi oluş, tedaviye uyumla ilişkili önemli etmenlerden biridir.

**Anahtar kelimeler:** Tip 2 Diyabet, tedaviye uyum, duygusal iyilik hali, hemşirelik

## INTRODUCTION

Type 2 diabetes is a chronic metabolic disease characterized by insulin deficiency and/or resistance, with multisystemic effects. Its incidence continues to rise due to aging, obesity, genetic predisposition, and sedentary lifestyles. The global increase and progression with complications necessitate lifelong treatment for affected individuals (Galicia-Garcia et al., 2020; Wei et al., 2025).

The primary goal of Type 2 diabetes management is effective glycemic control, which is essential for preventing complications such as cardiovascular disease, kidney failure, and neuropathy. Treatment compliance plays a critical role in this process because improved adherence reduces complications and mortality, whereas non-adherence increases morbidity and healthcare costs. Consequently, recent years have seen growing interest in identifying factors that influence glycemic control and treatment compliance (Demirtaş&Akbarak,2017;Pattnaiketal.,2019;Ülgüetal.,2023).

Worldwide, the prevalence of Type 2 diabetes has reached alarming levels, with an estimated 529 million people affected (Wei et al., 2025). In Türkiye, diabetes affects approximately 15.3-17.3% of adults, with important disparities according to age, socioeconomic status, and lifestyle (Ülgü et al., 2023). This growing disease burden further emphasizes the importance of improving treatment compliance to reduce complications and optimize long-term health outcomes.

Treatment compliance in Type 2 diabetes is a multidimensional process that includes adherence to medication, dietary recommendations, physical activity, weight management, regular follow-up, and self-care behaviors. Despite advances in diabetes treatment, maintaining long-term adherence remains a major challenge. The World Health Organization has consistently emphasized that adherence to chronic disease treatments remains below optimal levels, highlighting the need for interventions that support sustained treatment compliance in diabetes (Demirtaş & Akbarak, 2017; Erikmen & Keskin, 2022; Ülgü et al., 2023).

Beyond physical health, emotional well-being is increasingly recognized as a central component of diabetes care. Emotional well-being is a multidimensional construct that reflects an individual's capacity to maintain psychological

balance by enhancing positive emotional experiences while effectively coping with negative emotions. Unlike broader concepts such as mental health or quality of life, emotional well-being primarily focuses on the subjective experience of positive and negative affect. Positive emotional well-being encompasses emotions such as happiness, optimism, and life satisfaction, whereas negative emotional well-being is characterized by emotional distress, including feelings of anxiety, sadness, and hopelessness (Şimşek, 2011; Şimşek & Kuzucu, 2016). Stress and depression disrupt metabolic processes, impair insulin sensitivity, and worsen glycemic control, creating a vicious cycle of non-adherence and disease progression (Albai et al., 2024; Babenko et al., 2019; Mangoulia et al., 2024). While most patients adhere to physical health recommendations, emotional well-being is often neglected, underscoring the need for integrated approaches.

It is known negative emotional states such as depression, anxiety, and stress worsen treatment outcomes, yet the interaction between treatment compliance and emotional well-being remains insufficiently studied (Şimşek, 2011; Şimşek & Kuzucu, 2016). Given the global rise of diabetes—especially in developing countries—the burden on healthcare systems is unsustainable. In Türkiye, where prevalence is rapidly increasing (Ülgü et al., 2023), integrating psychological support into care may enhance treatment compliance and improve patient quality of life (Babenko et al., 2019; Mangoulia et al., 2024; Wei et al., 2025). The aim of the study was to examine the relationship between treatment compliance and emotional well-being in individuals with type 2 diabetes, to identify significant predictors of compliance, and to provide evidence that may guide holistic management strategies integrating both psychological and physical health.

## Hypotheses

**H1:** There is a significant relationship between emotional well-being and treatment compliance in individuals with type 2 diabetes.

**H2:** Positive emotional well-being is associated with better treatment compliance, whereas negative emotional well-being is associated with poorer treatment compliance.

## MATERIAL AND METHOD

### Study Place, Design and Study Population

This study was conducted in Türkiye using an online survey design, in accordance with STROBE checklist. It employed a descriptive, cross sectional design among patients with type 2 diabetes ( $\geq 18$  years) receiving medical treatment. The target population comprised individuals under follow up in outpatient settings; however, the exact population size could not be determined due to the absence of a centralized registry. Therefore, an unknown population sampling approach was applied. The minimum sample size for the study was determined using an a priori power analysis conducted in G\*Power version 3.1.9.4, based on the  $R^2$  increase in fixed-model multiple linear regression. Assuming a small effect size ( $f^2 = 0.02$ ), a significance level of 0.05, a statistical power of 0.80, two tested predictors, and a total of 24 predictors, the required minimum sample size was calculated as 485 (Kang, 2021). The final study sample consisted of 651 participants, which exceeded the required minimum sample size. Data were collected between April and June 2023 using the snowball method, resulting in 651 eligible participants who met the inclusion criteria ( $\geq 18$  years, diagnosed with type 2 diabetes for at least one year, receiving medical treatment, and providing informed consent).

### Data Collection Tools

**Personal information form:** This form was developed by the researchers based on a comprehensive literature review (Demirtaş & Akbayrak, 2017; Şimşek & Kuzucu, 2016). This form consisted of 16 items designed to collect data on sociodemographic variables (age, gender, marital status, education level, employment status, and income status) and disease-related factors (BMI, duration of diabetes diagnosis, type of treatment, presence of complications, hospitalization history, smoking and alcohol use, exercise habits, presence of other chronic diseases, and family history of diabetes).

**Patient Compliance Scale in Type 2 Diabetes Mellitus Treatment:** This scale was developed by Demirtaş & Akbayrak (2017) to assess compliance in type 2 diabetes treatment. It consists of 30 items on a 5 point Likert scale (1= strongly agree, 5= strongly disagree), with items 2, 4, 6, 7, 9, 10, 11, 12, 14, 18, 20, 21, 22, 24, 27, 28, and 30 reverse scored.

Total scores range from 30 to 150, where lower scores indicate better compliance. Scores of 30-54 (0-20%) reflect good adherence, 55-125 (20-80%) moderate adherence, and 126-150 (80-100%) poor adherence. In the original study, Cronbach's alpha was 0.77; in our study, reliability was confirmed with a value of 0.75 (Demirtaş & Akbayrak, 2017)

**Emotional Well-Being Scale:** This scale was developed and validated by Şimşek (2011). It consists of 14 items rated on a 5-point Likert scale (1= very little/not at all, 5= quite a lot) and includes two subdimensions: positive and negative emotional well-being. Items 1, 2, 5, 6, 7, 11, and 14 assess positive well-being, while items 3, 4, 8, 9, 10, 12, and 13 assess negative well-being. Negative items are reverse-scored, and the total score reflects overall emotional well-being, with higher scores indicating better outcomes (Şimşek, 2011; Şimşek & Kuzucu, 2016). In the original study, Cronbach's alpha was 0.85; in our study, it was 0.64. Although lower, values between 0.60 and 0.70 are considered acceptable in exploratory research and multidimensional constructs with limited items (Taber, 2018; Thorndike, 1995). Accordingly, findings related to this scale were interpreted with caution.

### Data Collection

Data were collected between April and June 2023 using a structured, self-administered online questionnaire. The survey was created on a web-based platform and distributed via social media and diabetes-related patient groups through snowball sampling. Participants accessed the survey through a shared link and completed it anonymously. An introductory page outlined the study aim, eligibility criteria, voluntary participation, confidentiality, and data protection. Electronic informed consent was obtained by requiring participants to actively confirm agreement ("I agree to participate") before proceeding. To ensure data quality, all questions were configured as mandatory, preventing participants from submitting incomplete questionnaires or skipping items. In addition, the survey settings were restricted to one response per participant, thereby preventing duplicate submissions. Consequently, no missing data were observed among the submitted questionnaires, and all 651 completed questionnaires that met the eligibility criteria were included in the final analyses.).

## Analysis of Data

Data were analyzed using IBM SPSS Statistics (version 22; IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies, percentages, means, standard deviations, minimum-maximum values) were used to summarize the data, and assumptions for parametric tests were evaluated. Pearson correlation analysis examined relationships between variables. Multiple linear regression analyses were initially conducted to explore predictive relationships. The primary analysis used hierarchical regression to determine the incremental contribution of variable sets. In Model 1, sociodemographic variables were entered; in Model 2, disease related variables were added; and in Model 3, positive and negative emotional well being variables were included. Categorical variables were converted into dummy variables, and the enter method was applied in all regression analyses. Statistical significance was set at  $p < 0.05$ , and procedures followed established methodological guidelines for regression analyses (Field, 2018; Tabachnick & Fidell, 2019).

## Ethical Approval

Before collecting data, ethical approval was obtained from Toros University Scientific Research and Publication Ethics Board (date/decision no: 23.03.2023/32). Approvals were obtained from the researchers concerned for the scales to be used in the study. In addition, written informed consent was obtained from the type 2 diabetes patients participating in the study via an online survey. The research was conducted within the rules of the Declaration of Helsinki.

## RESULT

The study included 651 patients with type 2 diabetes. Of these, 57.3% were female, 72.5% married, 63.1% using oral antidiabetic drugs, and 55.5% had another chronic disease. The mean age was  $57.82 \pm 16.16$  years, and the mean time since diagnosis was  $9.89 \pm 7.63$  years (Table 1).

**Table 1.** Characteristics of the participants

| Categorical variables      | Groups                       | n (%)      |
|----------------------------|------------------------------|------------|
| Gender                     | Female                       | 373 (57.3) |
|                            | Male                         | 278 (42.7) |
| Marital status             | Married                      | 472 (72.5) |
|                            | Single                       | 179 (27.5) |
| Educational level          | Literate                     | 129 (19.8) |
|                            | Elementary school            | 215 (33.0) |
|                            | High school                  | 188 (28.9) |
|                            | Associate degree             | 47 (7.2)   |
|                            | Bachelor degree              | 61 (9.4)   |
| Income status              | Postgraduate degree          | 11 (1.7)   |
|                            | Income less than expenses    | 245 (37.6) |
|                            | Income equal to expenses     | 289 (44.4) |
| Treatment                  | Income greater than expenses | 117 (18.0) |
|                            | OAD*                         | 411 (63.1) |
|                            | OAD & Insulin                | 114 (17.5) |
| Complications              | Insulin                      | 126 (19.4) |
|                            | Yes                          | 253 (38.9) |
| Hospitalization            | No                           | 398 (61.1) |
|                            | Yes                          | 161 (24.7) |
| Smoking                    | No                           | 490 (75.3) |
|                            | Yes                          | 176 (27.0) |
| Alcohol                    | No                           | 475 (73.0) |
|                            | Yes                          | 77 (11.8)  |
| Doing exercise             | Yes                          | 66 (10.1)  |
|                            | Occasionally                 | 231 (35.5) |
|                            | No                           | 354 (54.4) |
| Additional chronic disease | Yes                          | 361 (55.5) |
|                            | No                           | 290 (44.5) |
| DM in the family           | Yes                          | 457 (70.2) |
|                            | No                           | 194 (29.8) |

| Continuous variables                                                 | Mean±SD     | Diet difficulties in compliance   | 3-15 | 9.60±2.30  |
|----------------------------------------------------------------------|-------------|-----------------------------------|------|------------|
| Age                                                                  | 57.82±16.16 | Denial difficulties in compliance | 3-15 | 7.99±2.66  |
| Height                                                               | 164.48±9.21 | DM in the family                  | Yes  | 457 (70.2) |
| Weight                                                               | 77.59±15.39 |                                   | No   | 194 (29.8) |
| BMI                                                                  | 28.72±5.51  |                                   |      |            |
| Diagnosis time                                                       | 9.89±7.63   |                                   |      |            |
| DM= Diabetes Mellitus *BMI= Body Mass Index *SD = Standard Deviation |             |                                   |      |            |

The mean score of the Type 2 Diabetes Mellitus Treatment Compliance Scale was  $80.64 \pm 12.16$ , and the mean score of the Emotional Well Being Scale was  $47.92 \pm 11.94$  (Table 2).

**Table 2.** Mean values of the scales and their sub-scales

| Scales and sub-scales                               | Min-max | Mean±SD     |
|-----------------------------------------------------|---------|-------------|
| Emotional Well-Being                                | 14-70   | 47.92±11.94 |
| Positive emotional well-being                       | 7-35    | 21.59±7.36  |
| Negative emotional well-being                       | 7-35    | 26.33±6.55  |
| Type 2 Diabetes Mellitus Treatment Compliance Scale | 45-118  | 80.64±12.16 |
| Emotional difficulties in compliance                | 8-39    | 23.25±5.44  |
| Physical difficulties in compliance                 | 6-30    | 14.53±4.31  |
| Changing difficulties of habits in compliance       | 3-15    | 8.06±2.28   |
| Acceptance difficulties in compliance               | 3-15    | 8.01±2.39   |
| Awareness difficulties in compliance                | 4-18    | 7.94±2.60   |

The correlations between the scales and their subdimensions are presented in Table 3. A statistically significant, moderate negative correlation was found between treatment compliance scores and emotional well-being scores ( $r = -0.442$ ,  $p < 0.01$ ). Since higher scores on the Type 2 Diabetes Mellitus Treatment Compliance Scale indicate poorer treatment compliance, this finding suggests that better emotional well-being was associated with better treatment compliance (Table 3).

The results of the hierarchical multiple linear regression are presented in Table 4. Model 1 included sociodemographic variables (age, BMI, gender, income less than expenditure), which significantly affected compliance and explained 5% of the variance. Model 2 added disease related characteristics (time to diagnosis, oral antidiabetic drugs, insulin use, hospitalization in the last year, exercise, occasional exercise), increasing the explained variance from 5% to 20%. Model 3 incorporated positive and negative emotional well-being, increasing the explained variance to 32%. Positive emotional well-being was the strongest predictor of treatment compliance ( $\beta = -0.297$ ), with higher positive emotional well-being associated with lower treatment compliance scale scores, indicating better treatment compliance. In contrast, higher negative emotional well-being was associated with higher treatment compliance scale scores ( $\beta = 0.146$ ), indicating poorer treatment compliance. Of the 24 variables, 10 contributed significantly: PEWS ( $\beta = -0.297$ ), physical activity ( $\beta = -0.252$ ), NEWS ( $\beta = 0.146$ ), time to diagnosis ( $\beta = -0.132$ ), BMI ( $\beta = 0.094$ ), occasional physical activity ( $\beta = -0.190$ ), oral antidiabetic drug use ( $\beta = 0.155$ ), hospitalization in the last year ( $\beta = -0.114$ ), gender ( $\beta = 0.099$ ), and age ( $\beta = -0.102$ ) (Table 4).

**Table 3.** Relationship between treatment compliance and emotional well-being in patients with type 2 diabetes

| Scales and Sub-scales                         | Emotional Well-Being | Positive emotional well-being | Negative emotional well-being | Type 2 DM Treatment Compliance Scale | Emotional difficulties in compliance | Physical difficulties in compliance | Changing difficulties of habits in compliance | Acceptance difficulties in compliance | Awareness difficulties in compliance | Diet difficulties in compliance | Denial difficulties in compliance |
|-----------------------------------------------|----------------------|-------------------------------|-------------------------------|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------------------------|---------------------------------------|--------------------------------------|---------------------------------|-----------------------------------|
| Emotional Well-Being                          | r<br>p               | 1<br>0.875**<br>0.001         | -0.839**<br>0.001             | -0.442**<br>0.001                    | -0.539**<br>0.001                    | -0.310**<br>0.001                   | -0.291**<br>0.001                             | -0.349**<br>0.001                     | -0.225**<br>0.001                    | 0.222**<br>0.001                | 0.222**<br>0.001                  |
| Positive emotional well-being                 | r<br>p               | 1                             | -0.472**<br>0.001             | -0.329**<br>0.001                    | -0.407**<br>0.001                    | -0.270**<br>0.001                   | -0.220**<br>0.001                             | -0.253**<br>0.001                     | -0.198**<br>0.001                    | 0.277**<br>0.001                | 0.171**<br>0.001                  |
| Negative emotional well-being                 | r<br>p               |                               | 1                             | 0.435**<br>0.001                     | 0.525**<br>0.001                     | 0.261**<br>0.001                    | 0.282**<br>0.001                              | 0.351**<br>0.001                      | 0.188**<br>0.001                     | -0.094**<br>0.015               | -0.212**<br>0.001                 |
| Type 2 DM Treatment Compliance Scale          | r<br>p               |                               |                               | 1                                    | 0.732**<br>0.001                     | 0.694**<br>0.001                    | 0.579**<br>0.001                              | 0.690**<br>0.001                      | 0.527**<br>0.001                     | 0.130**<br>0.001                | 0.115**<br>0.003                  |
| Emotional difficulties in compliance          | r<br>p               |                               |                               |                                      | 1                                    | 0.261**<br>0.001                    | 0.335**<br>0.001                              | 0.716**<br>0.001                      | 0.125**<br>0.001                     | -0.015<br>0.001                 | -0.211**<br>0.001                 |
| Physical difficulties in compliance           | r<br>p               |                               |                               |                                      |                                      | 1                                   | 0.530**<br>0.001                              | 0.230**<br>0.001                      | 0.516**<br>0.001                     | -0.211**<br>0.001               | -0.048<br>0.224                   |
| Changing difficulties of habits in compliance | r<br>p               |                               |                               |                                      |                                      |                                     | 1                                             | 0.264**<br>0.001                      | 0.262**<br>0.001                     | -0.190**<br>0.001               | -0.243**<br>0.001                 |
| Acceptance difficulties in compliance         | r<br>p               |                               |                               |                                      |                                      |                                     |                                               | 1                                     | 0.151**<br>0.001                     | 0.077*<br>0.050                 | -0.063<br>0.109                   |
| Awareness difficulties in compliance          | r<br>p               |                               |                               |                                      |                                      |                                     |                                               |                                       | 1                                    | -0.118**<br>0.003               | 0.042<br>0.290                    |
| Diet difficulties in compliance               | r<br>p               |                               |                               |                                      |                                      |                                     |                                               |                                       |                                      | 1                               | 0.341**<br>0.001                  |
| Denial difficulties in compliance             | r<br>p               |                               |                               |                                      |                                      |                                     |                                               |                                       |                                      |                                 | 1                                 |

\*DM=Diabetes Mellitus

**Table 4.** Predictive level of treatment compliance as a function of descriptive characteristics and positive and negative emotional well-being in patients with type 2 diabetes

| Independent variables                | Model 1 |        |        |        |        |        | Model 2 |        |        |        |        |        | Model 3 |        |        |        |        |        |
|--------------------------------------|---------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------|
| Independent variables                | 95% CI  |        |        |        |        |        | 95% CI  |        |        |        |        |        | 95% CI  |        |        |        |        |        |
|                                      | B       | Std β  | t      | p      | LB     | UB     | B       | Std β  | t      | p      | LB     | UB     | B       | Std β  | t      | p      | LB     | UB     |
| Constant                             | 62.279  | -      | 11.507 | <0.001 | 51.651 | 72.906 | 81.239  | -      | 12.935 | <0.001 | 68.906 | 93.573 | 77.503  | -      | 12.419 | <0.001 | 65.248 | 88.759 |
| Age                                  | -0.079  | -0.105 | -2.157 | 0.031  | -0.151 | -0.007 | -0.094  | -0.124 | -2.641 | 0.008  | -0.163 | -0.024 | -0.077  | -0.102 | -2.357 | 0.019  | -0.141 | -0.013 |
| BMI                                  | 0.374   | 0.170  | 4.221  | <0.001 | 0.200  | 0.548  | 0.292   | 0.132  | 3.545  | <0.001 | 0.130  | 0.454  | 0.208   | 0.094  | 2.728  | 0.007  | 0.058  | 0.357  |
| Gender (Female)                      | 2.918   | 0.119  | 2.681  | 0.008  | 0.780  | 5.056  | 2.894   | 0.118  | 2.818  | 0.005  | 0.877  | 4.911  | 2.426   | 0.099  | 2.564  | 0.011  | 0.568  | 4.284  |
| Marital status (Married)             | -0.053  | -0.002 | -0.049 | 0.961  | -2.176 | 2.071  | -0.061  | -0.002 | -0.060 | 0.952  | -2.047 | 1.926  | -0.169  | -0.006 | -0.182 | 0.856  | -1.995 | 1.657  |
| ES*-Literate (Postgraduate)          | 6.814   | 0.223  | 1.747  | 0.081  | -0.846 | 14.475 | 4.993   | 0.164  | 1.382  | 0.167  | -2.102 | 12.088 | 6.339   | 0.208  | 1.909  | 0.057  | -0.182 | 12.859 |
| ES*-Elementary school (Postgraduate) | 7.368   | 0.285  | 1.949  | 0.052  | -0.056 | 14.791 | 5.339   | 0.206  | 1.520  | 0.129  | -1.559 | 12.237 | 5.545   | 0.214  | 1.716  | 0.087  | -0.799 | 11.899 |
| ES*-Secondary school (Postgraduate)  | 6.428   | 0.240  | 1.718  | 0.086  | -0.919 | 13.775 | 5.272   | 0.196  | 1.518  | 0.130  | -1.549 | 12.093 | 6.125   | 0.228  | 1.917  | 0.056  | -0.150 | 12.399 |
| ES*-Associate degree (Postgraduate)  | 4.485   | 0.095  | 1.126  | 0.260  | -3.334 | 12.304 | 5.809   | 0.124  | 1.572  | 0.116  | -1.448 | 13.065 | 6.107   | 0.130  | 1.798  | 0.073  | -0.554 | 12.779 |
| ES*-Bachelor degree (Postgraduate)   | 7.626   | 0.183  | 1.961  | 0.051  | -0.012 | 15.264 | 6.947   | 0.166  | 1.927  | 0.054  | -0.134 | 14.028 | 6.264   | 0.150  | 1.889  | 0.059  | -0.246 | 12.774 |
| Working (Yes)                        | -0.455  | -0.017 | -0.343 | 0.731  | -3.055 | 2.146  | -0.465  | -0.018 | -0.373 | 0.710  | -2.918 | 1.987  | -1.004  | -0.038 | -0.874 | 0.382  | -3.258 | 1.251  |
| Income status-Poor                   | 4.639   | 0.185  | 3.282  | 0.001  | 1.853  | 7.416  | 3.465   | 0.138  | 2.610  | 0.009  | 0.858  | 6.072  | 1.561   | 0.062  | 1.248  | 0.213  | -0.895 | 4.017  |
| Income status-Moderate               | 0.999   | 0.041  | 0.743  | 0.458  | -1.642 | 3.640  | 1.610   | 0.066  | 1.292  | 0.197  | -0.837 | 4.057  | 0.958   | 0.039  | 0.832  | 0.406  | -1.303 | 3.220  |
| Diagnosis time                       |         |        |        |        |        |        | -0.160  | -0.101 | -2.512 | 0.012  | -0.286 | -0.035 | -0.210  | -0.132 | -3.567 | <0.001 | -0.325 | -0.094 |
| OAD* (Insulin)                       |         |        |        |        |        |        | 4.219   | 0.167  | 3.227  | 0.001  | 1.729  | 6.709  | 3.899   | 0.155  | 3.323  | 0.001  | 1.595  | 6.202  |

**Table 4.** Predictive level of treatment compliance as a function of descriptive characteristics and positive and negative emotional well-being in patients with type 2 diabetes (Continued)

| Independent variables                                                                                                            |        | Model 1 |   |   |    |        | Model 2                                                                                                        |        |        |        |         | Model 3 |         |                                                                                                               |        |        |         |        |  |  |
|----------------------------------------------------------------------------------------------------------------------------------|--------|---------|---|---|----|--------|----------------------------------------------------------------------------------------------------------------|--------|--------|--------|---------|---------|---------|---------------------------------------------------------------------------------------------------------------|--------|--------|---------|--------|--|--|
| Independent variables                                                                                                            | 95% CI |         |   |   |    | 95% CI |                                                                                                                |        |        |        | 95% CI  |         |         |                                                                                                               |        |        |         |        |  |  |
|                                                                                                                                  | B      | Std β   | t | p | LB | UB     | B                                                                                                              | Std β  | t      | p      | LB      | UB      | B       | Std β                                                                                                         | t      | p      | LB      | UB     |  |  |
| OAD & Insulin (Insulin)                                                                                                          |        |         |   |   |    |        | 3.115                                                                                                          | 0.097  | 2.152  | 0.032  | 0.272   | 5.959   | 1.821   | 0.057                                                                                                         | 1.357  | 0.175  | -0.814  | 4.455  |  |  |
| Complication (Yes)                                                                                                               |        |         |   |   |    |        | -0.551                                                                                                         | -0.022 | -0.502 | 0.616  | -2.706  | 1.604   | -0.057  | -0.002                                                                                                        | -0.056 | 0.955  | -2.038  | 1.924  |  |  |
| Hospitalization (Yes)                                                                                                            |        |         |   |   |    |        | -5.173                                                                                                         | -0.184 | -4.269 | <0.001 | -7.552  | -2.793  | -3.211  | -0.114                                                                                                        | -2.848 | 0.005  | -5.425  | -0.997 |  |  |
| Smoking (Yes)                                                                                                                    |        |         |   |   |    |        | -0.112                                                                                                         | -0.004 | -0.102 | 0.919  | -2.262  | 2.038   | -0.159  | -0.006                                                                                                        | -0.158 | 0.875  | -2.134  | 1.816  |  |  |
| Alcohol (Yes)                                                                                                                    |        |         |   |   |    |        | -0.997                                                                                                         | -0.026 | -0.664 | 0.507  | -3.947  | 1.953   | -1.008  | -0.027                                                                                                        | -0.730 | 0.466  | -3.717  | 1.702  |  |  |
| Exercise (Yes)                                                                                                                   |        |         |   |   |    |        | -12.384                                                                                                        | -0.307 | -7.982 | <0.001 | -15.431 | -9.337  | -10.171 | -0.252                                                                                                        | -7.068 | <0.001 | -12.997 | -7.345 |  |  |
| Exercise – Occasionally (Yes)                                                                                                    |        |         |   |   |    |        | -5.700                                                                                                         | -0.224 | -5.870 | <0.001 | -7.606  | -3.793  | -4.841  | -0.190                                                                                                        | -5.400 | <0.001 | -6.601  | -3.080 |  |  |
| DM* in family (Yes)                                                                                                              |        |         |   |   |    |        | -0.394                                                                                                         | -0.015 | -0.414 | 0.679  | -2.263  | 1.475   | -0.224  | -0.008                                                                                                        | -0.254 | 0.800  | -1.957  | 1.509  |  |  |
| PEWS                                                                                                                             |        |         |   |   |    |        |                                                                                                                |        |        |        |         |         | -0.551  | -0.297                                                                                                        | -7.660 | <0.001 | -0.692  | -0.409 |  |  |
| NEWS                                                                                                                             |        |         |   |   |    |        |                                                                                                                |        |        |        |         |         | 0.241   | 0.146                                                                                                         | 3.706  | <0.001 | 0.114   | 0.369  |  |  |
| Dependent variable: Compliance with treatment                                                                                    |        |         |   |   |    |        | Dependent variable: Compliance with treatment                                                                  |        |        |        |         |         |         | Dependent variable: Compliance with treatment                                                                 |        |        |         |        |  |  |
| Durbin-Watson:1.973, F:4.275, p<0.001, R:0.273, R²:0.074, Adjusted R²:0.057, R² change:0.074, F change:4.275                     |        |         |   |   |    |        | Durbin-Watson:1.973, F=12.719, p<0.001, R=0.480, R²=0.230, Adjusted R²:0.203, R² change:0.156, F change:12.719 |        |        |        |         |         |         | Durbin-Watson:1.973, F=9.973, p<0.001, R=0.594, R²=0.353, Adjusted R²:0.328, R² change:0.123, F change:59.430 |        |        |         |        |  |  |
| CI: Confidence interval LB: Lower bound UB: Upper bound DM: Diabetes Mellitus ES*: Education status OAD*: Oral antidiabetic drug |        |         |   |   |    |        |                                                                                                                |        |        |        |         |         |         |                                                                                                               |        |        |         |        |  |  |

## DISCUSSION

In this study, our findings that patients demonstrated a moderate level of compliance are consistent with previous studies (Özkaptan et al., 2019; Pattnaik et al., 2019). This moderate level is clinically significant, as insufficient adherence may hinder optimal glycemic control and elevate the risk of long term complications such as neuropathy, retinopathy, or cardiovascular disease. The fact that negative emotional well being emerged as an important predictor highlights the interplay between psychological distress and behavioral adherence. Depression, anxiety, and pessimism have been associated with lower motivation and maladaptive coping strategies, such as emotional eating, which may contribute to poorer treatment compliance (Albai et al., 2024). Moreover, weight gain and recent hospitalization may be associated with emotional distress and poorer treatment compliance, suggesting a complex relationship among these factors (Mangoulia et al., 2024). These findings suggest that compliance is not merely a matter of pharmacological adherence but requires integrated psychosocial support.

Female participants showed lower treatment compliance than males, consistent with previous studies (Venditti et al., 2023). One possible explanation is that women often experience greater psychosocial burden, including caregiving responsibilities, household duties, and sociocultural expectations, and report higher levels of depressive symptoms and diabetes-related distress. These factors have been associated with lower treatment compliance in previous research. Our findings suggest that gender differences may be considered when interpreting treatment compliance among individuals with type 2 diabetes, although further studies are needed to better understand the underlying mechanisms.

Higher BMI is common among individuals with type 2 diabetes and has been associated with poorer health outcomes. Consistent with our findings, previous studies have also reported an association between higher BMI and lower treatment compliance. In addition, elevated BMI has been associated with impaired metabolic regulation and poorer glycemic control (Chandrasekaran & Weiskirchen, 2024). Therefore, the observed association between BMI and treatment compliance in the present study may reflect the complex interplay

between metabolic, behavioral, and lifestyle-related factors.

In the present study, hospitalization during the previous year was associated with poorer treatment compliance. Previous studies have reported that hospitalization is often accompanied by increased psychological distress, including stress, anxiety, depression, and hopelessness, which may be associated with treatment-related behaviors. Furthermore, chronic stress has been associated with emotional eating and obesity-related behaviors (Ata et al., 2023; Chandrasekaran & Weiskirchen, 2024). Therefore, the association observed in our study may reflect the complex relationship between hospitalization, psychological well-being, and treatment compliance.

Oral antidiabetic medications are an essential component of type 2 diabetes management. In the present study, the use of oral antidiabetic drugs was associated with treatment compliance. Previous studies have reported that adherence to oral antidiabetic therapy varies considerably, with many patients experiencing difficulties maintaining regular medication use (Christofides, 2019; Piragine et al., 2023). Poor adherence to medication has been associated with suboptimal glycemic control and unfavorable clinical outcomes in the literature. Therefore, the association observed in our study may reflect the complex relationship between medication use and overall treatment-related behaviors.

Our study found that exercise, positive emotional well-being, increasing age, and longer duration of diagnosis were associated with better treatment compliance. Exercise may support treatment compliance through both improved glycemic control and reduced stress (Ambelu & Teferi, 2023; Hulett et al., 2022). Similarly, better emotional well-being was associated with better treatment compliance, highlighting the importance of psychosocial factors in diabetes management. Increasing age and longer disease duration may reflect greater disease acceptance, knowledge, and established self-management routines, consistent with previous studies (Ekitli et al., 2025; Pattnaik et al., 2019).

These findings suggest that emotional well-being should be considered alongside physical health in the management of individuals with type 2 diabetes. Younger and newly diagnosed patients may require closer follow-up and greater attention to

psychosocial factors that may influence treatment compliance. Since this was a cross-sectional study, causal relationships cannot be established. Future longitudinal and interventional studies are needed to further clarify the relationship between emotional well-being and treatment compliance.

### LIMITATION

While this study provides valuable insights into the relationship between emotional well-being and treatment compliance, several limitations should be noted. First, the cross sectional design limits causal inference; future longitudinal studies are needed. Second, data were collected via online survey and snowball sampling, which may have introduced selection bias and limited representativeness. Individuals with restricted internet access or lower digital literacy, particularly older adults, may have been underrepresented. Thus, findings should be generalized cautiously to the broader population in Türkiye. A notable limitation is the absence of clinically validated biomarkers (e.g., HbA1c), due to reliance on anonymous self reported data and constraints in accessing medical records. Although self reported compliance was the focus, future studies could incorporate objective measures (pill counts, continuous glucose monitoring) and explore cultural factors across regions. Finally, the relatively low internal consistency of the emotional well being scale requires cautious interpretation of related findings.

### CONCLUSION

This study highlights the significant role of emotional well-being in treatment compliance among Type 2 diabetes patients. Negative emotional well-being is a key barrier, while positive emotional health, exercise, and longer disease duration contribute positively. Given the complex nature of diabetes management, holistic care addressing physical, emotional, and psychosocial aspects is essential. Healthcare providers should integrate emotional health assessments into routine care to better support patients. Future studies could examine psychosocial interventions (e.g., cognitive-behavioral therapy, mindfulness) and investigate cultural and socioeconomic factors influencing compliance, particularly in diverse populations. Such insights may guide more personalized and effective interventions for diabetes management.

### AUTHORSHIP CONTRIBUTION

Concept: EÇ, EA, HAD; Design: EÇ, EA, HAD; Supervision: EÇ; Data Collection: EÇ, EA, HAD; Analysis: EÇ, HAD; Writing: EÇ, EA, HAD; Critical Review: EÇ, EA, HAD

### DECLARATION OF INTERESTS

The authors declare no conflicts of interest.

### FINANCIAL DISCLOSURE

The authors declare received no financial support for this research.

### ETHICAL APPROVAL

Before collecting data, ethical approval was obtained from Toros University Scientific Research and Publication Ethics Board (date/decision no: 23.03.2023/32). Approvals were obtained from the researchers concerned for the scales to be used in the study. In addition, written informed consent was obtained from the type 2 diabetes patients participating in the study via an online survey. The research was conducted within the rules of the Declaration of Helsinki.

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