

ORIGINAL ARTICLE

Psychometric properties of the Turkish EQ-5D-5L in adults with type 2 diabetes mellitus

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ABSTRACT

Objective: Type 2 Diabetes Mellitus (T2DM) is generally examined in terms of medications, laboratory results, and potential complications, but patients' own perceptions of their health are also important. The EuroQol 5-Dimension 5-Level (EQ-5D-5L) scale provides patients to summarize their self-assessed health status in key areas. This study aimed to evaluate the psychometric performance of the Turkish EQ-5D-5L in adults with T2DM.

Methods: This methodological cross-sectional study was conducted between March and June 2025 at a family health center in the Karatay district of Konya, Türkiye. The study sample comprised 273 adults with T2DM who responded to an online questionnaire consisting of the EQ-5D-5L, the Short Form-12 Health Questionnaire (SF-12), and a sociodemographic form. Reliability was examined using internal consistency and a two-week test-retest assessment. Validity was assessed through structural validity, known-groups comparisons, and convergent/discriminant validity with the SF-12. Ceiling and floor effects were also evaluated.

Results: Cronbach's alpha for the EQ-5D-5L was 0.849. Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were 0.951 and 0.901, respectively, while Root Mean Square Error of Approximation (RMSEA) was 0.152. The EQ-5D-5L index score showed a strong correlation with the SF-12 Physical Component Summary ($r = 0.706$). Ceiling effect of 20.5% and no floor effect were observed.

Conclusion: The Turkish version of the EQ-5D-5L appears to be a concise and practical tool for assessing quality of life in adults with T2DM, with generally supportive evidence for reliability and validity. However, some caution is warranted regarding structural validity, particularly in light of the elevated RMSEA observed in the factor analysis. Further studies in other disease groups and larger samples are needed to strengthen generalizability and to better capture mental health dimensions.

Keywords: Type 2 Diabetes Mellitus, EQ-5D-5L, Turkish Version, Psychometrics, Health-Related Quality of Life

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INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a major chronic health issue worldwide and contributes substantially to morbidity and mortality. The management of this disease is not limited to glycemic control issues; long-term treatment process, presence of comorbidities, and lifestyle restrictions also affect patients' health-related quality of life (HRQoL)¹. In daily practice, fasting blood glucose, glycated hemoglobin, and the presence of complications often receive the most attention, but how patients feel, how they manage daily activities, and how they view their future are also integral parts of treatment success. In this manner, patient-reported outcomes (PROs) have gained importance. PROs capture the patient's own perception of health, functioning, and emotional state, without being filtered through clinical judgment. PROs instruments help set treatment goals together with the patient, prevent overreliance on biochemical markers alone when evaluating interventions, and provide additional data for health policy planning².

The EuroQol Group developed the EQ-5D family which is used as an HRQoL instrument. The EQ-5D-5L scale has improved discrimination capabilities due to the five dimensions it offers. Using a country-specific value set, the EQ-5D-5L provides both a descriptive health profile and a single index score, which is widely used for comparisons across different disease groups³. Adapting the EQ-5D-5L to a new language and culture requires more than translation alone. The adapted instrument should measure the same construct as the original, show acceptable measurement error, and differentiate between known groups⁴.

Several studies suggest that the EQ-5D-5L performs well in T2DM⁵⁻⁷. Nevertheless, the Turkish EQ-5D-5L has not been examined in detail, and its measurement properties have not been comprehensively evaluated in adults with T2DM. Given the high prevalence of diabetes in Türkiye, further research in this area is necessary. This study was designed to address that gap. Our aim was to examine, in adults with T2DM, the internal consistency, test-retest reliability, factor structure, known-groups validity, and convergent/discriminant validity of the Turkish EQ-5D-5L.

METHOD

This study was planned methodologically and cross-sectionally, and was conducted between March and June 2025 at the Ulurmak Family Health Center located in the Karatay district of Konya, Türkiye. All data were obtained via an online form. Participants were recruited using a convenience sampling approach from adults with T2DM registered at the family health center, which constituted the recruitment frame. The survey link was created using Google Forms and distributed to eligible patients during routine clinical contact, and participants accessed the questionnaire via a direct link. The questionnaire consisted of three main parts: a short sociodemographic and clinical information form, the Turkish version of the EQ-5D-5L, and the SF-12 Health Survey. Before the study began, written permission to use the official Turkish EQ-5D-5L translation was granted by the EuroQol Research Foundation (Registration ID: 74020).

Ethical approval obtained from the Ethics Committee for Non-Interventional Clinical Research at KTO Karatay University, Faculty of Medicine (Approval No:2025/008) with protocol number 111943 (decision no:008, date: 12 June 2025). All participants were fully informed about the purpose and procedures of the study and provided informed consent, in accordance with the principles outlined in the Declaration of Helsinki.

Adults (≥ 18 years) with physician-diagnosed T2DM according to current American Diabetes Association criteria⁸, who could understand and complete an online form independently or with minimal assistance, were invited to participate. Diagnosis of T2DM, comorbidities, treatment regimen, and diabetes duration were verified through electronic medical records at the family health center. Patients with type 1 diabetes, frequent acute complications, known serious psychiatric illness, significant cognitive impairment, or severe visual, auditory, or motor limitations that would prevent them from answering the questionnaire were excluded from the study.

Population and sample selection

A priori sample size estimation was performed before research. Assuming a correlation of 0.30 between EQ-

5D-5L and SF-12 scores, and targeting 90% statistical power, the minimum number of participants was calculated as 219. To compensate for incomplete or unusable responses, a higher target was set. The study was conducted on 273 individuals who met all the participation criteria.

EuroQol 5-Dimension 5-Level (EQ-5D-5L)

Health status is assessed across five domains by this instrument: mobility, self-care, usual activities, pain or discomfort, and anxiety or depression. There are five levels of response, from “no problems” to “extreme problems”. Responses across the five dimensions form a five-digit health profile. Using country-specific value sets, these profiles can be transformed into a single index value. In the present study, EQ-5D-5L index values were derived using the EuroQol-recommended 5L-3L crosswalk approach. Because a country-specific EQ-5D-5L value set for Türkiye is not currently available, responses to the EQ-5D-5L descriptive system were first mapped onto EQ-5D-3L health states using the official crosswalk algorithm developed by van Hout et al⁹. Utility scores were then calculated using the UK EQ-5D-3L value set (Dolan tariff)¹⁰. Under this value set, index values theoretically range from 1.000 (full health) to approximately -0.594, with 0 representing a health state equivalent to death, and negative values indicating health states considered worse than death according to population preference weights. Missing EQ-5D-5L dimension responses were handled using a complete-case approach. The instrument also contains a visual analogue scale (EQ-VAS). Patients rate their overall health “today” on a 0-100 line. (0 = the worst health, 100 = the best health)³.

Short Form-12 Health Survey (SF-12)

This scale assesses perceived health during the preceding four weeks by means of 12 items. These items are combined into two principal summary scores: the Physical Component Summary (PCS-12) and the Mental Component Summary (MCS-12)¹¹. Previous work on the Turkish SF-12 has reported acceptable Cronbach’s alpha coefficients (PCS-12: 0.73 and MCS-12: 0.72)¹². Scoring follows the standard SF-12 algorithm. Certain items are reverse-coded, each response is translated into a numeric value, and these values are weighted and summed.

Then, PCS-12 and MCS-12 raw scores are converted to standardized scores using a reference distribution (mean=50, standard deviation=10)¹¹.

Statistical analysis

IBM SPSS Statistics 26.0 was used for statistical analyses, IBM SPSS AMOS 26.0 for confirmatory factor analysis. For continuous variables, distributional properties were explored with the Kolmogorov-Smirnov test. Internal consistency of the scales were evaluated by calculating Cronbach’s alpha coefficients and item-total correlations. Cronbach’s alpha coefficients of ≥ 0.70 were considered acceptable¹³. EQ-5D-5L index values were calculated using the EuroQol-recommended 5L-3L crosswalk algorithm⁹ implemented in IBM SPSS Statistics, based on syntax derived from the official EuroQol crosswalk methodology. Ceiling effect was defined as the proportion of participants reporting the maximum index value (1.000), corresponding to full health (profile 11111). Floor effect was defined as the proportion reporting the minimum index value observed in the sample, corresponding to the most severe health states. To evaluate temporal stability, a subgroup of 54 participants completed the EQ-5D-5L again after a two-week interval. The test-retest subgroup consisted of participants who agreed to complete the questionnaire again after two weeks and were selected from the original sample on a voluntary basis, without additional eligibility criteria. Index scores were analyzed using an intraclass correlation coefficient (ICC) based on a two-way mixed-effects model, single measurement and absolute agreement¹⁴. ICC values below 0.50 indicate poor reliability, values between 0.50 and 0.75 indicate moderate reliability, and values between 0.75 and 0.90 indicate good reliability¹⁵.

Structural validity was examined with a series of complementary analytical procedures. We used the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett’s test of sphericity to check whether our data were suitable for running a factor analysis^{16,17}. An exploratory assessment of dimensionality was then conducted using principal component analysis (PCA) to examine whether the EQ-5D-5L items could be summarized by a single

underlying dimension; the retained component, item loadings, eigenvalue, and explained variance were reported. Finally, confirmatory factor analysis (CFA) was performed using maximum likelihood estimation to test an a priori one-factor model. Model fit was evaluated using the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and the chi-square to degrees-of-freedom ratio (χ^2/df). CFI and TLI values ≥ 0.95 indicated good fit, while values between 0.90 and 0.95 indicated acceptable fit, RMSEA values were interpreted with conventional cut-offs (e.g., ≤ 0.05 good, 0.05-0.08 acceptable, >0.10 poor), and χ^2/df values around 2-3 indicated acceptable fit^{18,19}. Hypothesis testing for construct validity was evaluated with known-groups validity and convergent/discriminant validity. Known-groups validity was examined through comparisons of EQ-5D-5L index scores among subgroups (e.g., age, sex, educational level, presence of comorbidities, diabetes duration, and treatment regimen). Two-group comparisons used independent-samples t-tests, whereas multi-group comparisons used Welch's ANOVA when variances were unequal (Levene's test), followed by Games-Howell post-hoc tests for significant omnibus results. Convergent and discriminant validity were evaluated by Pearson correlation coefficients between EQ-5D-5L scores and SF-12 summary scores (PCS-12 and MCS-12). P values <0.05 were statistically significant. Because some education categories contained small

cell sizes that could yield unstable estimates, education was collapsed into three more robust strata prior to known-groups analysis: Primary or less (illiterate and primary school), Secondary (middle and high school), and University (university degree or higher).

RESULTS

Participant characteristics and descriptive EQ-5D-5L outcomes

Data from 273 adults with T2DM were analyzed. The mean age was 58.95 ± 11.28 years (range: 28-85), and 57.9% (n=158) of participants were female. Mean diabetes duration was 14.53 ± 10.50 years. In total, 71.4% (n=195) reported at least one additional chronic condition.

In terms of treatment, 6.6% (n=18) were not using any antidiabetic medication, 64.5% (n=176) were taking only oral antidiabetic drugs, 11.0% (n=30) were on insulin alone, and 17.9% (n=49) were using both oral agents and insulin. The mean EQ-5D-5L index score was 0.70 ± 0.26 (minimum -0.01, maximum 1.00). The mean EQ-VAS score was 68.80 ± 17.46 , with values ranging from 0 to 100. Figure 1 illustrates the distribution pattern of the index scores. The distribution of EQ-5D-5L utility index scores showed a bimodal pattern, with one cluster at lower-to-moderate values and a second cluster at higher values. Comparisons of mean EQ-5D index and EQ-5D-VAS scores by sociodemographic and clinical characteristics are shown in Table 1.

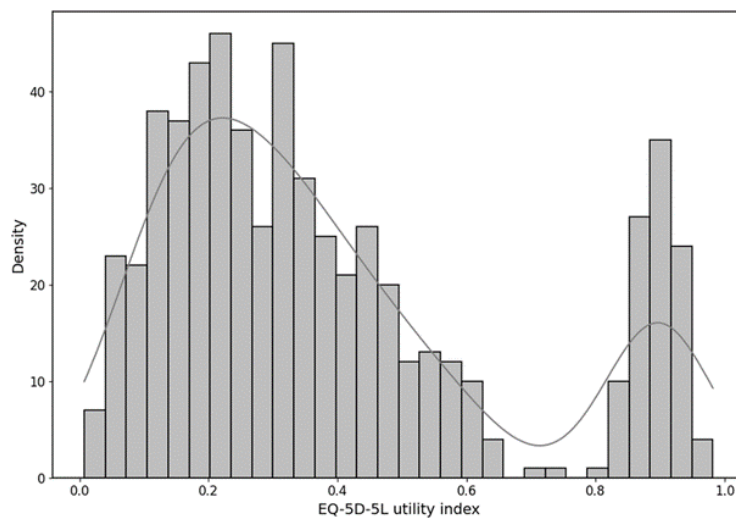
Table 1. Comparison of mean EQ-5D-5L index scores and EQ-5D-5L VAS scores according to sociodemographic and clinical characteristics

Parameters		n	EQ-5D-5L index score (Mean $\pm$ SD)	EQ-5D-5L index score		EQ-5D-5L VAS score	
				t/F	p	t/F	p
Age	18-44 years	26	0.814 $\pm$ 0.232	2.80	0.059	0.373	0.773
	45-54 years	76	0.827 $\pm$ 0.173				
	55-64 years	84	0.680 $\pm$ 0.255				
	65 years and over	87	0.585 $\pm$ 0.292				
Gender	Female	158	0.667 $\pm$ 0.256	-2.73	<0.001	-3.357	<0.001
	Male	115	0.754 $\pm$ 0.270				

Table 1. Continued

Marital status	Single	37	0.631±0.180	-1.81	0.072	0.599	0.552
	Married	236	0.715±0.274				
Education level	Primary or less	95	0.548±0.263	12.62	<0.001	5.911	<0.001
	Secondary	51	0.704±0.247				
	University	127	0.821±0.208				
Employment Status	Actively working	83	0.872±0.143	7.61	<0.001	5.136	<0.001
	Not working	190	0.630±0.270				
Economic status	Poor	33	0.713±0.141	3.82	0.025	0.774	0.464
	Moderate	184	0.676±0.273				
	Good	56	0.791±0.276				
Medication use	Not using	18	0.744±0.190	1.58	0.205	2.290	0.087
	OAD	176	0.711±0.236				
	Insulin	30	0.768±0.305				
	OAD+Insulin	49	0.623±0.341				
Comorbidities	Present	195	0.661±0.273	-4.34	<0.001	-2.644	0.009
	Absent	78	0.810±0.209				
Duration of diabetes	0-4 years	66	0.737±0.214	19.4	<0.001	1.1	0.339
	5-9 years	29	0.854±0.119				
	10 years and over	178	0.667±0.289				

SD: Standard Deviation. VAS: Visual Analog Scale. t/F = t-test for independent two-group comparisons. F-test for ANOVA in multi-group comparisons. OAD: Oral Antidiabetic Drug. For variables with more than two categories, p values reflect omnibus tests. When significant, pairwise differences were explored using Games-Howell post-hoc tests in main text. Education groups were collapsed as follows: Primary or less = illiterate + primary school; Secondary = middle + high school; University = university or higher.

**Figure 1.** Histogram and density plot of EQ-5D-5L index scores in the study sample

The histogram illustrates the frequency distribution of index values, while the overlaid density curve represents the smoothed distribution of health utility scores in the study population.

Reliability

Cronbach's alpha for the EQ-5D-5L was 0.849. Item-total correlations ranged from 0.482 to 0.803, and deleting any single item resulted in alpha values between 0.780 and 0.860, indicating that no item disproportionately affected internal consistency and supporting the scale's overall reliability (Table 2). Cronbach's alpha coefficients were 0.862 for PCS-12 and 0.751 for MCS-12. In the test-retest subsample (n=54), the ICC for the EQ-5D-5L index score was 0.82 (95% CI: 0.73-0.89).

Structural validity

The KMO value was 0.814, and Bartlett's test of sphericity was significant ($\chi^2(10)=635.986$, $p<0.001$), indicating that the correlation matrix was suitable for factor analysis.

Exploratory analysis (Principal component analysis results)

PCA was performed to evaluate the dimensionality of the EQ-5D-5L. Loadings ranged from 0.673 to 0.808 (Table 2). The component yielded an eigenvalue of approximately 3.17 and accounted for 63.4% of the total variance, supporting a unidimensional structure in this sample.

Table 2. Item analysis and factor loadings of the EQ-5D-5L dimensions

Item	Item-Total Correlation	Cronbach's Alpha if Item Deleted	Factor Loading
EQ-Mobility	0.734	0.804	0.802
EQ-Selfcare	0.617	0.829	0.673
EQ-Usual Activities	0.803	0.780	0.808
EQ-Pain/Discomfort	0.706	0.808	0.742
EQ-Anxiety/Depression	0.482	0.860	0.749
Factor loadings are from the exploratory analysis (principal component extraction)			

Confirmatory factor analysis (CFA) results

Model fit indices were mixed. CFI (0.951) indicated good incremental fit, whereas TLI (0.901) suggested acceptable-but not good-incremental fit. In contrast,

χ^2/df (3.42) and RMSEA (0.152) indicated poor fit on absolute criteria. The chi-square test was significant ($p<0.001$), indicating lack of exact fit (Table 3).

Table 3. Confirmatory factor analysis, fit indices for the EQ-5D-5L

Fit Index	Value	Recommended Threshold
χ^2/df	3.42	2-3 acceptable ¹⁹
CFI	0.951	≥ 0.95 good; 0.90-0.95 acceptable ^{18,19}
TLI	0.901	≥ 0.95 good; 0.90-0.95 acceptable ^{18,19}
RMSEA	0.152	<0.08 good; <0.10 moderate; >0.10 poor ¹⁹
χ^2/df : Chi-square to degrees-of-freedom ratio, CFI: Comparative Fit Index, TLI: Tucker-Lewis Index, RMSEA: Root Mean Square Error of Approximation		

Hypothesis testing for construct validity

Known-groups validity

No statistically significant differences in EQ-5D-5L index scores were observed across age groups ($p=0.059$). Men reported higher mean EQ-5D-5L index scores than women ($p<0.001$). After collapsing education into three categories, EQ-5D-5L index scores differed significantly across education levels ($p<0.001$), with higher scores observed among participants with university education. EQ-5D-5L index scores differed significantly across economic status groups in the overall analysis ($p=0.025$). Post-hoc comparisons showed that participants with good economic status had significantly higher EQ-5D-5L index scores than those with moderate economic status ($p=0.019$). No statistically significant differences were observed between others.

Participants without comorbid conditions reported

significantly higher EQ-5D-5L index scores than those with at least one additional chronic disease ($p<0.001$). Index scores also differed according to diabetes duration ($p<0.001$). Post-hoc analyses indicated that individuals with a diabetes duration of 5-9 years had higher index scores than those with a duration of 0-4 years ($p=0.002$) and those with a duration of 10 years or longer ($p<0.001$). No significant difference was observed between the 0-4 year and ≥ 10 year groups ($p=0.134$).

Finally, EQ-5D-5L index scores did not differ significantly according to diabetes treatment modality ($p=0.205$) and marital status ($p=0.072$) (Table 1).

Convergent and discriminant validity

The EQ-5D-5L index score showed a strong positive correlation with the PCS-12 score ($r=0.706$) and a moderate positive correlation with the MCS-12 score ($r=0.396$) (Table 4).

Table 4. Correlation coefficients between EQ-5D-5L and SF-12

	PCS-12	MCS-12	EQ-MO	EQ-SC	EQ-UA	EQ-PD	EQ-AD	EQ-VAS	EQ-Index
PCS-12	1	0.282	-0.632	-0.453	-0.667	-0.695	-0.302	0.477	0.706
MCS-12		1	-0.251	-0.215	-0.250	-0.352	-0.488	0.417	0.396
EQ-MO			1	0.611	0.701	0.658	0.355	-0.315	-0.864
EQ-SC				1	0.625	0.431	0.318	-0.234	-0.746
EQ-UA					1	0.670	0.503	-0.414	-0.852
EQ-PD						1	0.476	-0.470	-0.838
EQ-AD							1	-0.438	-0.635
EQ-VAS								1	0.461

PCS: Physical Component Summary, MCS: Mental Component Summary, MO: Mobility, SC: Selfcare, UA: Usual Activities, PD: Pain/Discomfort, AD: Anxiety/Depression, VAS: Visual Analog Scale

Ceiling and floor effects

Although the lowest observed EQ-5D-5L index score was -0.01, there was no meaningful accumulation of scores at the lower end of the distribution; thus, no floor effect was observed. By contrast, 20.5% of the sample reported the maximum index value.

DISCUSSION

We evaluated the Turkish EQ-5D-5L in adults with

T2DM, a high-burden chronic condition with major public health implications. Across the main domains, the scale performed consistently, suggesting that it can be used in Türkiye to capture HRQoL in adults with T2DM.

Internal consistency was acceptable in our study. Despite the brief five-dimension structure of the EQ-5D-5L, acceptable Cronbach's alpha (0.849), indicating that the dimensions are sufficiently interrelated and reflect a common HRQoL construct.

This result is comparable to reports in other patient groups and in population-based studies. Safieddine et al. evaluated the measurement properties of the Creole and French EQ-5D-5L in adults with T2DM and reported acceptable internal consistency (alpha for the Creole version: 0.76 and the French version: 0.81)⁶. Hernandez et al.²⁰ reported an alpha of 0.69 in asthm. In a multicenter lung cancer cohort study conducted in Türkiye, internal consistency ranged from 0.791 at diagnosis to 0.943 after radiotherapy²¹. Kontodimopoulos found it to be 0.743 in the general population²². In our data, alpha value did not increase when any single dimension was removed, and item-total correlations supported the contribution of each dimension to the overall score. It should be noted that the EQ-5D-5L is a preference-based instrument with an ordinal structure; therefore, Cronbach's alpha may not fully capture its measurement properties. Nevertheless, it was reported to allow comparison with previous validation studies that have used similar approaches^{3,4}.

The EQ-5D-5L showed good temporal stability in our research. Over the two weeks, the score stayed consistent (ICC=0.82). In other words, when people's health hasn't really changed, the EQ-5D-5L gives very similar results each time. A similar finding has been reported, the EQ-5D-5L index score showed a test-retest ICC of 0.70 in Thai diabetes patients, indicating acceptable stability²³.

Indicators of construct validity suggested that factor analysis was warranted. Because Bartlett's test was significant and the KMO value was adequate, the EQ-5D-5L dimensions were sufficiently related to each other^{16,17}. Factor analysis supported a single underlying factor: all loadings were above 0.40, suggesting that the scale can be summarized as one overall HRQoL measure. This is in line with the EQ-5D-5L's design, which combines five key health domains into a single summary framework^{3,24}.

In the CFA, the fit results were mixed: CFI suggested good fit (0.951) and TLI was borderline (0.901), but RMSEA was high (0.152), pointing to poor absolute fit. It is worth noting that RMSEA can be inflated in very short scales with few degrees of freedom²⁵, so this value should be interpreted cautiously; however, it still

lies well above commonly used cut-offs and suggests a meaningful level of misfit. In comparison, Safieddine et al.⁶ found that a one-factor CFA showed good fit in adults with T2DM (RMSEA=0.06 and 0.02; CFI close to 1), supporting the use of the EQ-5D-5L as a single HRQoL construct in that setting. Taken together, our findings offer partial support for a unidimensional interpretation of the Turkish EQ-5D-5L in adults with T2DM; nonetheless, the elevated RMSEA suggests that more detailed instruments may be preferable when a finer assessment is needed. Moreover, the elevated RMSEA indicates that the covariance structure among the five EQ-5D-5L dimensions does not fully align with a strict one-factor solution, suggesting that the dimensions may retain partially distinct information beyond a purely unidimensional representation. Further studies in other clinical groups and larger, more diverse samples are warranted to clarify model fit across settings.

Known-groups analyses showed that the EQ-5D-5L index differed in some areas. These patterns support the scale's known-groups validity. Age-related differences in HRQoL did not reach statistical significance in this sample. In our study, HRQoL did not decline monotonically with increasing diabetes duration. Instead, participants with a duration of 5-9 years reported higher EQ-5D-5L index scores than both the 0-4 year and ≥ 10 year groups, while no significant difference was observed between the shortest and longest duration categories. This non-linear pattern suggests that the relationship between disease duration and HRQoL may reflect adaptation processes, differences in comorbidity burden, or age-related confounding rather than a simple cumulative disease effect. Interestingly, patients using insulin alone showed numerically higher EQ-5D-5L index scores; however, differences across treatment modalities did not reach statistical significance in our analysis. This pattern may reflect closer clinical follow-up or better treatment engagement in selected patients receiving insulin, rather than a direct effect of insulin therapy itself. Previous studies have reported mixed findings, with some associating insulin use with poorer HRQoL due to treatment burden, while others suggest potential benefits in patients achieving good glycemic control^{26,27}.

Correlation findings showed a stronger relationship between the EQ-5D-5L index and PCS-12 than between the index and MCS-12. This suggests that the instrument captures physical aspects of health status more clearly than mental well-being in this sample. A similar pattern has been reported in earlier studies, where the EQ-5D-5L tends to align more closely with physical domains of generic HRQoL instruments than with their mental domains²².

The ceiling effect in this study was found to be 20.5%, which is within the acceptable range of 10-25% reported in the literature for the EQ-5D-5L^{1,7,23}. In the study by Hernandez et al.²⁰, the floor effect was zero and the ceiling effect was reported as 26.5%. A ceiling effect exceeding 20% suggests that the scale may have limited sensitivity in distinguishing variation among individuals with very high health status and may be less responsive in population screenings or in groups with low disease severity^{1,7,23}. This ceiling effect may reduce the instrument's sensitivity in distinguishing between individuals with relatively mild disease burden and in detecting subtle but clinically meaningful differences or changes in health status within this subgroup.

This study has several limitations. First, data were collected online and relied on self-report, which may introduce recall and response biases. Participation may also have been shaped by digital literacy, potentially under-representing individuals with limited literacy or internet access. This may have resulted in a sample that overrepresents individuals who are more digitally engaged or have better access to healthcare resources, potentially limiting the representativeness of the findings and their generalizability to the broader T2DM population. For some participants, responses may have been entered with assistance from family members or caregivers, which could have affected how items were interpreted. Moreover, the observed ceiling effect suggests that the EQ-5D-5L may have limited discriminative capacity among respondents with very good health states. Because of the cross-sectional design, responsiveness of the instrument to clinical change over time could not be evaluated in this study. These limitations should be considered when interpreting the findings.

CONCLUSION

This research examined the measurement performance of the Turkish EQ-5D-5L in adults with T2DM. Overall, the scale exhibited good internal consistency, strong test-retest reliability, and supportive evidence for construct validity, indicating that it can be used to assess HRQoL in this population. The EQ-5D-5L may capture physical health more clearly than psychological well-being. For a more detailed evaluation of mental health, supplementary instruments may therefore be useful. Taken together, the findings support the Turkish EQ-5D-5L as a brief and practical measure for both clinical practice and research in T2DM, while further studies in other patient groups and larger, more diverse samples are needed to strengthen generalizability.

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