ORIGINAL ARTICLE

Development and Evaluation of a Turkish Scale to Assess Medication Literacy for Adults

Ozgenur TORUN[1], İlkay MEMİÇ[1], Pınar AY[2], Mesut SANCAR[1], Aysu SELCUK[3], Ecehan BALTA[4], Vildan OZCAN[4], Betul OKUYAN[1]*

[1]Marmara University, Faculty of Pharmacy, Department of Clinical Pharmacy, İstanbul, Türkiye
[2]Marmara University, Faculty of Medicine, Department of Public Health, İstanbul, Türkiye
[3]Ankara University, Faculty of Pharmacy, Department of Clinical Pharmacy, Ankara, Türkiye
[4]Turkish Pharmacists' Association, Ankara, Türkiye

ABSTRACT

Objectives: This study aimed to develop a Turkish scale to assess medication literacy and to evaluate its psychometric properties among adults having at least 12 years of education in Türkiye.

Materials and Methods: After the composition of a preliminary set of items, the content validity of the scale was assessed by an e-Delphi process and a pilot study. The psychometric properties of the scale were evaluated in 358 participants, who had above 12 years of education: university students, academics and, administrative staff from two faculties (pharmacy and law) in two universities located in two major cities (İstanbul and Ankara) in Türkiye between March and May, 2021. The test-retest validity was assessed by Spearman's rho and Wilcoxon test. Internal consistency was evaluated by Kuder Richardson 20. Principal component analysis was conducted.

Results: The last version of the medication literacy scale consisted of 8 items. There was a positive correlation (Spearman's rho: 0.570; $p < 0.01$) and no significant difference ($p = 0.308$) between the scores of the scale at baseline and after a two-week interval. Kuder Richardson 20 coefficient was 0.659. Students and graduates of health sciences and participants with high reading ability of health-related information had significantly higher scores on the medication literacy scale ($p < 0.001$).

Conclusion: Turkish version of the Medication Literacy Scale for Adults is a valid tool for evaluate medication literacy among adults, who have above 12 years of education in Türkiye. The generalizability of our findings should be evaluated with caution since this study was conducted in a sample with a significant representation from healthcare professionals. It would be useful to conduct further studies evaluating the psychometric properties of this scale in participants with diverse characteristics.

Key words: Medication literacy, scale, clinical pharmacy, validation, measure, health literacy

INTRODUCTION

Medication literacy is defined as "the degree to which individuals can obtain, comprehend, communicate, calculate, and process patient-specific information about their medications to make informed medication and health decisions in order to safely and effectively use their medications, regardless of the mode by which the content is delivered (*e.g.*, written, oral, and visual)".[1]

Medication literacy is essential for enabling individuals to safely use unprescribed medications, herbal products, and dietary supplements in addition to the prescribed medications.[2] Individuals with poor medication literacy could improperly manage their medications, leading to medication-related problems, including medication adherence.[3] Promoting individuals' capability toward rationale medication use is crucial to avoiding potential medication-related problems.

A medication literacy scale, which is designed to evaluate the counseling and educational needs of healthy individuals in primary care (such as community pharmacies) and clinical settings, should be valid and reliable as well as not time-consuming and easily applicable. Worldwide, there are only a few specific tools or scales for measuring medication literacy.[4,5] The Recognition and Addressing of Limited Pharmaceutical

Literacy (RALPH), developed by Vervloet et al.[6], is an interview guide for pharmacists in identifying the individuals with limited medication literacy implicitly. RALPH interview guide determines medication literacy by asking questions about the medications used by the patient. However, this scale is not applicable to healthy individuals, who do not use medication regularly.[7] There are also scales that are constructed based on vignette scenarios and medication leaflets and instructions.[2,8-10] Vignette-based questions with instructions assess individuals' understanding and interpretation of medication information. However, vignette-based scales are mostly composed of questions specific to the health system of the country, where the scale had been developed,[2,8] so, they are not suitable for cultural adaption.

In Türkiye, more than half of the adults have inadequate or limited health literacy levels. This problem is clear also among participants who are university graduates and/or who have a higher educational level (https://sggm.saglik.gov.tr/Eklenti/39699/0/soya-rapor-1pdf.pdf) Accessed date: 1 April 2022. Still, there is currently no Turkish scale to evaluate individuals' medication literacy levels.

This study aimed to develop a scale of medication literacy in Turkish [Medication Literacy Scale for Adults (MELSA-TR)] and evaluate its psychometric properties among adults having at least 12 years of education (including Turkish university students, academics, and administrative staff) in Türkiye.

MATERIALS AND METHODS

Ethical approval
Ethical approval for this study was received from Marmara University, Institute of Health Science Ethical Board Committee, İstanbul, Türkiye (date: 14/09/2020; file number: 77). Participants were provided electronic informed consent to participate in the study.

The study was reported on the basis of the recommendations of the consensus-based standards for selecting health status measurement instruments (COSMIN) statement.[11] The study design is presented in Figure 1.

Composition of a preliminary set of items
The scale items were developed considering the literature.[2,9,12,13] The research team also reviewed drug leaflets and patient education brochures to generate the items. As the first version of MELSA-TR, twenty-seven draft items were created using virtual medicine boxes and instructions. Both performance-based (such as calculation) and perception-based (interpretation of instructions given) items related to the prescribed medications/non-prescribed medications/dietary supplements/herbal medicines were included. These items were created based on numeracy, prose, and document literacy.[2] Each item of the scale had a dichotomous score (1: for the correct response and 0: for the wrong response and the option of no idea/don't know).
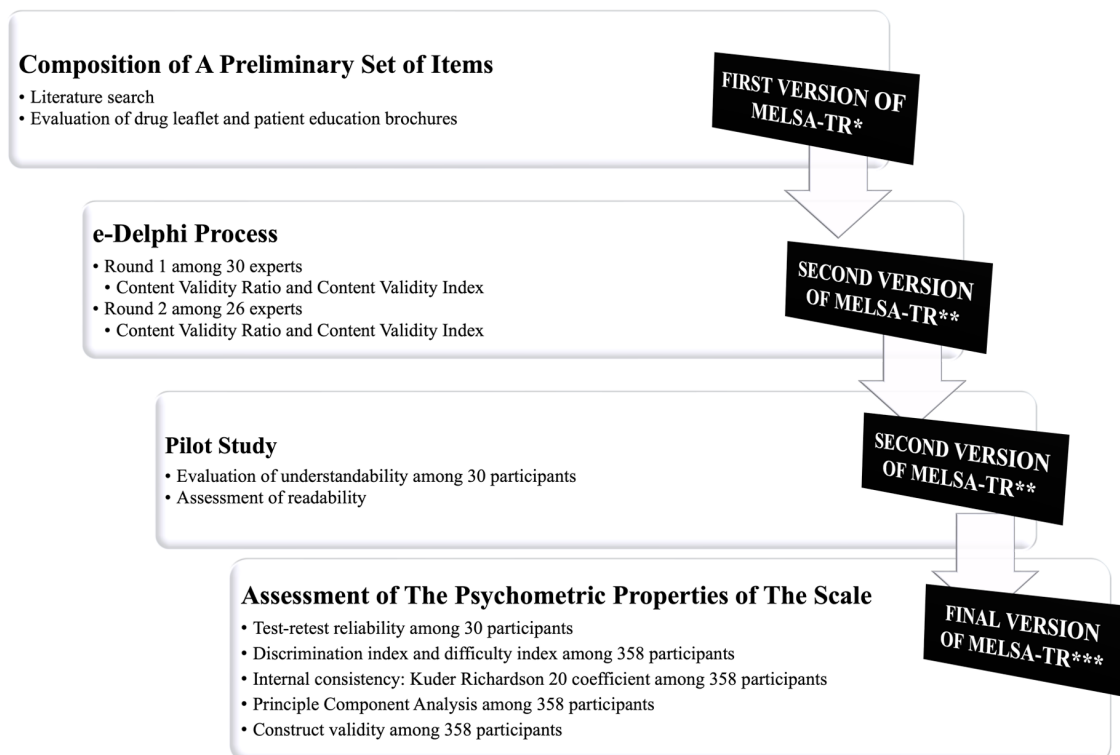

Figure 1. Flowchart representing the development and evaluation of MELSA-TR process. *It consisted of 27 items, **It consisted of 23 items, ***It consisted of 8 items

e-Delphi process

The content validity of the scale was assessed by an e-Delphi process between December 2020 and February 2021. A national multidisciplinary group of experts working on health literacy (including community pharmacists, hospital pharmacists, a health sociologist, a clinical psychologist, a public health expert, nurses, a pharmacologist, clinical pharmacists, physicians, a pedagogist, and an education specialist) participated in the e-Delphi process. A link to the online survey was generated on the Marmara University Questionnaire System, which is powered by the Lime Survey©, and invitation letters were sent to the experts by email. After receiving their informed consent electronically, the questionnaire link was sent individually with a password. The participants were asked to complete the questionnaire within three weeks.

The experts were asked whether the items would be relevant to medication literacy. The experts rated each item with a 4-point Likert scale [from very irrelevant (1) to very relevant (4)] and provided suggestions and comments to evaluate the clarity and comprehensibility of the questions (about the type, visual, and grammar of the items) by filling in the comment box for each item. At the end of each round, the content validity ratio (CVR) and the content validity index (CVI) were calculated for each item.[14] If the item-CVI was less than 0.70, the item was excluded from the scale. If the item CVI was in the range of 0.70-0.79, it was revised. If CVR value of the item was negative, it was excluded from the scale.[15]

Two separate rounds were conducted within four weeks intervals for the e-Delphi study. Thirty-six experts from various disciplines were invited to the e-Delphi study. Thirty experts participated in round 1. At the end of round 1, four items in the scale were excluded based on the CVR and CVI findings. The items were re-written according to the feedback and suggestions of the experts. Twenty-six experts participated in round 2. No items were excluded and no other items were added to the scale in round 2, while the second version of MELSA-TR consisted of 23 items.

Pilot study

A pilot study was conducted on 30 adults (a separate sample of individuals who were recruited neither in the test-retest nor the psychometric study) for the second version of MELSA-TR. The participants assessed the comprehensibility of the items. It took an average of 10-15 minutes to complete the scale. The readability of the total scale was evaluated by the Turkish evaluation formula, which was developed by Ateşman[16] and it was found to be average, with a score of 65.3.

Assessment of the psychometric properties of the scale

An online survey was conducted between March and May, 2021. The sample size for validation studies is recommended to be ten times the number of items in the scale, so it was calculated that at least 300 participants would be required for an adequate sample size.[17] The study population consisted of university students, academics, and administrative staff from two faculties (pharmacy and law) in two universities located in two cities (İstanbul and Ankara) in Türkiye. Because of the restrictions (including a curfew and social distance) during the coronavirus disease-2019 (COVID-19) pandemic, an online survey was conducted in both Delphi processes and the psychometric analysis. Due to the difficulties in reaching individuals with low education levels, this study was conducted only on individuals with an education level of above 12 years using convenience sampling. In Türkiye, the compulsory education year has been 12 since 2012 (https://www.resmigazete.gov.tr/eskiler/2012/04/20120411-8.htm Accessed date: 1 February 2022). The population of this study had a medium to high level of education according to the International Standard Classification of Education (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_Standard_Classification_of_Education_(ISCED)#Implementation_of_ISCED_2011_.28levels_of_education.29 Accessed date: 1 February 2022).

Socio-demographic variables [age, sex, faculty, and degree (year), having a bachelor's degree or associate degree in health sciences for academic and administrative staff, perceived socioeconomic status, use of prescribed medication/unprescribed medication/vitamin, and perceived general health assessment] were collected.

Turkish version of the Single Item Literacy Screener developed by Morris et al.[18] was used to evaluate the need for individuals for reading and comprehension of health-related materials. The item was as follows: "How often do you need someone to help you, when you read instructions, pamphlets, or other written material from your doctor or pharmacy?". A 5-Likert scale (ranging from never to always) was used in this self-report instrument, and the cut-off was greater than 2 to identify subjects with limited reading ability for health-related information.

Two-week test-retest reliability for the second and final versions of MELSA-TR was evaluated on 30 participants (a separate sample of individuals who were recruited neither in the test-retest nor the psychometric study). The discrimination index (which was considered as excellent if it was greater than 0.4) and the difficulty index (which is considered as difficult if it was less than 30%) were calculated.[19]

Kuder Richardson 20 coefficient was calculated to determine the internal consistency of the scale. A shorter and more reliable version of the scale with 8 items was created taking into consideration the discrimination index, the difficulty index, and Kuder Richardson 20 coefficient. Principal component analysis was conducted.

The following hypothesis was tested to evaluate the construct validity of the scale: *Students (fourth and fifth-grade students of faculty of pharmacy) and graduates (academic and administrative staff with bachelor's degree or associate degree in health science) of health science have higher scores on the medication literacy scale compared with participants who did not have any education in health sciences.* The study was conducted among all university students, regardless of their grades. However, the hypothesis was restricted to only the fourth and fifth-grade students of the faculty of pharmacy because the pharmacy students have been receiving professional pharmacy courses in these grades

according to the national pharmacy core education program in Türkiye (https://www.yok.gov.tr/Documents/Kurumsal/egitim_ogretim_dairesi/Ulusal-cekirdek-egitimi-programlari/eczacilik_cep.pdf Accessed date: 1 February 2022).

Statistical analysis

Descriptive data were presented as medians (25th-75th percentiles) and numbers (percentages), where appropriate. Kolmogorov-Smirnov test was used to assess the normality of the data. Since the data did not follow a normal distribution, continuous variables for two and more than two groups were compared with Mann-Whitney *U* and Kruskal-Wallis tests, respectively. Kuder Richardson 20 coefficient was calculated to determine internal consistency. Principal component analysis was conducted. Spearman's correlation and Wilcoxon test were used to evaluate test-retest reliability. $P < 0.05$ was set as the level of statistical significance. Data analysis was performed by IBM® SPSS® 11 software.

RESULTS

The online survey link was accessed by 752 participants. Fourteen participants declined to participate. Three hundred eighty participants did not complete the survey. Therefore, 358 of 752 (47.6%) were included in the analysis. The median (25th-75th percentiles] age was 22 (21-24) years (minimum-maximum: 19-62). The characteristics of the participants (n: 358) are presented in Table 1.

For the final version of MELSA-TR, the test-retest reliability (n: 30) showed a positive correlation between the scores of the scale at baseline and after a two-week interval (Spearman's rho: 0.570; $p < 0.01$). There was no significant difference between the test and retest scores (p=0.308) (data not shown).

Kuder Richardson 20 coefficient was 0.762 for the second version of MELSA-TR. The final version was limited to 8 items taking into consideration the content of the items, discrimination index, the difficulty index, and Kuder Richardson 20 coefficient. Kuder Richardson 20 coefficient was 0.659 for the final version consisting of 8 items. The median (25th-75th percentiles) score of the scale was 8.0 (7.0-8.0). Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.776 with Bartlett's Test of Sphericity was significant ($p < 0.001$). Only one factor was extracted by principal component analysis. The content of the items, the proportion of correct responses, corrected item-total correlation, and Kuder Richardson 20 coefficient if item deleted for each item are presented in Table 2.

Students (fourth and fifth-grade students of faculty of pharmacy) and graduates (academic and administrative staff with bachelor's degrees or associate degrees in health science) of health science had significantly higher scores on the medication literacy scale compared with the participants who did not have any education on health sciences [the median (25th-75th percentiles): 8.0 (8.0-8.0) *vs.* 7.0 (6.0-8.0), respectively; $p < 0.001$]. Female participants had significantly higher scores on medication literacy scale compared with the males [the median (25th-75th percentiles): 8.0 (7.0-8.0) *vs.* 7.0 (6.0-8.0), respectively; p=0.001]. Participants with the high reading ability

of health-related information had significantly higher scores on the medication literacy scale compared with those having the limited reading ability [the median (25th-75th percentiles): 8.0 (7.0-8.0) *vs.* 7.0 (6.0-8.0), respectively; p=0.002]. Medication literacy scale scores by participants' characteristics are presented in Table 3.

DISCUSSION

Content validity, the test-retest validity, internal consistency, and construct validity of MELSA-TR were confirmed in this study. Like the previously developed medication literacy scales,[2,8,10] Kuder Richardson 20 coefficient of MELSA-TR was determined as 0.659 and acceptable. Therefore, we suggest that MELSA-TR is a valid tool for adults having at least 12 years of education. However, we used a sample with a significant representation from healthcare professionals so the generalizability of our

Table 1. Characteristics of the participants (n: 358)	
	n (%)
Sex	
Female	272 (76.0)
Male	86 (24.0)
Students* or graduates of health sciences**	
Yes	134 (37.4)
No	224 (62.6)
Perceived socioeconomic status	
Low	3 (0.8)
Low-moderate	82 (22.9)
Moderate	186 (52.0)
High-moderate	75 (20.9)
High	12 (3.4)
Use of prescribed medications/unprescribed medication/vitamins	
Yes	105 (29.3)
No	253 (70.7)
Perceived general health	
Perfect	16 (4.5)
Pretty good	135 (37.7)
Good	161 (45.0)
Not bad	43 (12.0)
Bad	3 (0.8)
SILS	
High reading ability for health-related information	289 (80.7)
Limited reading ability for health-related information	69 (19.3)

SILS: Single Item Literacy Screener, *Fourth and fifth-grade students of the faculty of pharmacy **Academic and administrative staff with bachelor's degree or associate degree in health science

findings for adults with a medium to high level of education should be evaluated with caution. It would be useful to conduct further studies evaluating the psychometric properties of this scale in participants with diverse characteristics.

Like similar medication literacy scales,[2,8-10] our scale consisted of numeracy questions (including calculation of dose and refill prescription date) items related to prose and document literacy. Neiva Pantuzza et al.[5] defined four constructs of medication literacy: functional literacy, communicative literacy, critical literacy, and numeracy. The items in MELSA-TR had items to assess all these constructs. During the COVID-19 pandemic, an infodemic had arisen,[20] so, we included two items related to critical and communicative literacy about the news on social media/television and purchasing herbal medicine on the internet, the advice taken from relatives/friends, and communication with physicians/pharmacists.

Study limitations
We used an online survey to determine the psychometric properties of the scale due to COVID-19 pandemic, which might have resulted with a selection bias. The participants who used the internet more frequently and/or were more interested in medication information might have participated more, resulting with an overestimation of total scores. Also, in an online survey, the participants might have gotten some guidance in filling out the questionnaire. The participants were adults with medium to high level of education who had worked and/or studied at universities, and some of them were health science students and/or professionals, which also limit the generalizability of the findings.

CONCLUSION

MELSA-TR could be used to evaluate the medication literacy levels of adults having at least 12 years of education in Türkiye. There is still a need to test the psychometric properties of the scale on diverse populations, particularly on socioeconomic disadvantaged groups, before using it extensively. This scale has many advantages, such as being a self-reported, valid, easily applicable, and not time-consuming tool. It also does not consist

Table 2. Content of the items and proportion of correct responses, corrected item-total correlation and Kuder Richardson 20 Coefficient if item deleted for each item of MELSA-TR (n: 358)

Items	Classification	Content of the item	Proportion of correct responses n (%)	Corrected item-total correlation	Kuder Richardson 20 coefficient if item deleted
Item-1	e-Medication literacy	After the news on social media/television about its harmful effects, deciding to continue taking a regularly used medicine, if the physicians'/pharmacists tell it is safe	319 (89.1)	0.306	0.639
Item-2	Dose	Selecting appropriate pediatric dose of paracetamol suspension according to child's age and weight (a dose table presented to the participants)	292 (81.6)	0.343	0.633
Item-3	Indication	Selecting the right medicine for heartburn according to indication information on the medicine box (the virtual medicine boxes presented to the participants)	266 (74.3)	0.376	0.628
Item-4	Calculating total daily dose	Calculating the total daily paracetamol dose in two products containing paracetamol (daily dose regimen and the virtual medicine boxes presented to the participants)	315 (88.0)	0.470	0.596
Item-5	Calculating time for dose	Calculating administration timing of an antibiotic dose	328 (91.6)	0.368	0.625
Item-6	Dose administration	Deciding whether a re-shake is needed or not before each dose of antibiotic suspension if it has been diluted, prepared, and shake in the initial use. The antibiotic suspension had a warning as "shake before each dose"	354 (98.9)	0.336	0.651
Item-7	Potential drug-drug interaction	Selecting appropriate administration timing of two medications (levothyroxine and iron product) that should be taken at different times because of a potential drug-drug interaction (the virtual instruction presented to the participants)	327 (91.3)	0.451	0.606
Item-8	Storage	Deciding about the storage conditions of an oral suspension bottle (the virtual instruction presented to the participants)	313 (87.4)	0.300	0.641

MELSA-TR: Medication Literacy Scale for Adults-Türkiye

Table 3. MELSA-TR scores by participants' characteristics (n: 358)

	MELSA-TR score Median (25th-75th percentiles)	p value
Sex		
Female	8.0 (7.0-8.0)	0.001
Male	7.0 (6.0-8.0)	
Students* or graduates of health sciences**		
Yes	8.0 (8.0-8.0)	<0.001
No	7.0 (6.0-8.0)	
Perceived socioeconomic status		
Low and low-moderate	8.0 (6.5-8.0)	
Moderate	8.0 (6.75-8.0)	0.844
High and high-moderate	7.0 (7.0-8.0)	
Use of prescribed medication/unprescribed medication/vitamin		
Yes	8.0 (7.0-8.0)	0.127
No	7.0 (6.0-8.0)	
Perceived general health		
Perfect and pretty good	8.0 (7.0-8.0)	
Good	8.0 (7.0-8.0)	0.188
Bad and not bad	7.0 (6.0-8.0)	
SILS		
High reading ability for health-related information	8.0 (7.0-8.0)	0.002
Limited reading ability for health-related information	7.0 (6.0-8.0)	

SILS: Single Item Literacy Screener; *Fourth and fifth-grade students of the faculty of pharmacy **Academic and administrative staff with bachelor's degree or associate degree in health science, MELSA-TR: Medication Literacy Scale for Adults-Türkiye

of items related to the country-based healthcare system. Still, we note that further studies among participants with diverse characteristics (particularly on socioeconomic disadvantaged groups) would be useful for evaluating psychometric properties in more detail.

Ethics

Ethics Committee Approval: Ethical approval for this study was received from Marmara University, Institute of Health Science Ethical Board Committee, İstanbul, Türkiye (date: 14/09/2020; file number: 77).

Informed Consent: Participants provided electronic informed consent to participate in the study.

Peer-review: Externally peer-reviewed.

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