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The psychometric evaluation of the Turkish version of the Mann Assessment of Swallowing Ability in patients in the early period after stroke

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Background/aim: The Mann Assessment of Swallowing Ability (MASA) is an efficient tool that allows physicians to *determine* the alertness, cooperation, and respiration of patients, which are *important* factors when assessing *swallowing*. This study aimed to translate the MASA into Turkish (T-MASA) and to assess its reliability and validity in patients during the *early period* after a *stroke*.

Materials and methods: The scale was administered to 141 patients in the early period after a stroke. For reliability, both internal consistency (Cronbach's alpha and corrected item-to-total correlations) and interrater reliability were analyzed. The procedures were scored by two blinded independent expert observers. The validity was assessed using the convergent validity. The cut-off value of the T-MASA for dysphagia was accepted as 169 points. The correlation between the MASA and endoscopic evaluation was evaluated.

Results: The T-MASA showed good internal consistency using Cronbach's alpha (0.899–0.901) and corrected item-to-total correlations. In addition, the intraclass correlation coefficient scores indicated excellent agreement. A significant moderate negative correlation was found between endoscopic evaluation and the T-MASA in terms of the presence of dysphagia (r: –0.324, r: –0.302, respectively, and both P = 0.001)

Conclusion: Our results suggest that the Turkish version of the MASA is a valid and reliable instrument when determining dysphagia in patients in the early period after a stroke.

Key words: Dysphagia, stroke, bedside screening test, Mann Assessment of Swallowing Ability

1. Introduction

Dysphagia is one of the most common and life-threatening complications for patients with neurologic disorders, especially following a stroke (1,2). Although it is usually observed during the first month with an incidence of 42%–67%, minor swallowing abnormalities have been reported in almost all stroke patients (3–5). Therefore, it is rational to infer that the first month is a critical and sensitive period for patients with stroke.

Dysphagia may lead to dehydration, malnutrition, airway obstruction, aspiration pneumonia, and even death (6,7). Aspiration pneumonia is the most important complication of dysphagia and is seen in half of all stroke patients during the first year, 40%–70% of which is the silent type, with a mortality rate as high as 45% (8). In stroke management guidelines, it is reported that if dysphagia is recognized and treated early, complications may be reduced and the functioning of patients may be increased (7,9,10).

Various methods are available for the early detection and identification of dysphagia, such as videofluoroscopy (VF) and endoscopic methods, as well as bedside screening tests (9,11). However, these methods are precise diagnostic methods; as well as being invasive and expensive, they also require special equipment and skilled personnel. Thus, bedside screening tests are preferred by many researchers due to their ease and quick application, as well as their repeatable, cost-effective, and noninvasive characteristics (11).

Bedside screening tests include a wide range of methods that include observation during the swallowing of liquid and foods, and standardized questionnaires for oral-motor symptoms and cranial nerve, gross motor, and cognitive functions (9,10,12–14).

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The Mann Assessment of Swallowing Ability (MASA) is one of the most efficient bedside screening tests when evaluating dysphagia and monitoring swallowing skills over a period of time (13,14). In its developmental stage, the MASA was shown to be valid and reliable for patients in the early period after a stroke when compared with VF (13,14). It has been used to diagnose neurogenic dysphagia due to various disorders, and a specific form using the MASA was established for patients with cancer. Moreover, the MASA has been accepted as a reference test for comparison with newly developed tests (15–17). However, there are only two non-English versions (Dutch and Korean) used in studies concerning its reliability and validity in the literature (18,19). One of these is an abstract presentation (not an article) of a Dutch reliability study involving patients in the early period after a stroke, like the original version, and the other study includes patients with chronic stroke over a mean 10.9-month duration, unlike the original version.

Stroke is reported to be a cause of death with increasing prevalence in aging populations in Turkey, as it is in the world (20). Turkish studies have shown that dysphagia is common in these patients at an early stage and affects patients' quality of life (5,21,22). Therefore, it is also important in Turkey to evaluate stroke patients early and effectively at the bedside. However, there is currently no valid and reliable bedside screening test in Turkish that can evaluate swallowing function in stroke patients during the early stages.

Hence, the aim of this study was to translate the MASA into Turkish and to assess its reliability and validity in patients in the early period after a stroke.

2. Materials and methods

2.1. Study design and patients

This study was performed with 174 consecutive acute stroke patients who were admitted to our physical medicine and rehabilitation (PMR) clinic between January 2013 and January 2016. Thirty-three patients who were transferred to other clinics due to medical problems or who were unable to comply with the rehabilitation process were excluded. Thus, the study was completed with 141 patients.

The study was approved by the local institutional ethics committee. Prior to the evaluation, the patients or their legal guardians, as appropriate, were given verbal and written information on the nature of the study. Informed consent forms were signed upon admission to the trial. All procedures were conducted in accordance with the Helsinki Declaration of 2004.

The inclusion criteria were patients aged between 55 and 75 years who presented within the first month of onset of stroke as confirmed using magnetic resonance imaging, who had head control in the sitting position, alertness, and normal cognitive function (cut-off value of ≥24 according to Mini Mental State Examination score).

Patients with a history of malignancy, head and neck surgery, previous stroke, pulmonary or swallowing disorders, dementia or psychiatric disorders, or bilateral infarcts were excluded. Additionally, the presence of contagious or infectious diseases, nasal obstruction, decompensated heart disease, and any risk of bleeding were exclusion criteria due to contraindications for flexible fiberoptic endoscopic evaluation of swallowing (FEES).

2.2. Data collection

Demographic and disease characteristics, including age, sex, educational status, stroke type, affected hemispheric side of stroke, and elapsed time after stroke, were recorded.

2.3. Instruments

The stroke severity of the patients and functional disability were assessed using the National Institute of Health Stroke Scale (NIHSS) and functional impairment measure (FIM), respectively. Motor functional status was graded from 1 to 6 using the Brunnstrom stage for upper extremity, hand, and lower extremity.

On the NIHSS scale, patients were evaluated in categories including consciousness, language, dysarthria, eye movement, visual field, neglect, facial paresis, proximal limb strength, extremity ataxia, and sensorial function. Each category was scored between 0 and 2 or 0 and 4; total scores are between 0 and 42. FIM also analyzes two different aspects of motor and cognitive disability. There are 18 questions and 6 sections including self-care, sphincter control, transfers, locomotion, communication, and social cognition, with each item being scored from 1 to 7.

2.3.1. Mann Assessment of Swallowing Ability (MASA)

The MASA is a 24-item clinical bedside evaluation tool for stroke patients (13,14). It has been validated in patients with acute stroke, and it has also been used as a reference test for the comparison of newly developed dysphagia tests in different disorders (17). It is used to evaluate every stage of swallowing from preoral to pharyngeal phases including adequacy of cranial nerve function by sensorial and oromotor components, oral preparation, bolus clearance, and pharyngeal response related to swallowing function, as well as cognitive competence such as alertness, cooperation, and auditory comprehension necessary for successful swallowing. In addition, the MASA allows physicians to make judgments concerning the severity of dysphagia and aspiration severity in order to predict the aspiration risk rating on swallowing integrity and diet recommendation.

The 24 items included in the MASA are as follows: alertness, cooperation, auditory comprehension,

respiration, respiratory rate for swallowing, dysphasia, dyspraxia, dysarthria, saliva, lip seal, tongue movement, strength and coordination, oral preparation, gag reflex, palate, bolus clearance, oral transit time, cough reflex, voluntary cough, voice, trachea, pharyngeal phase, and pharyngeal response. Each question is scored using a scoring system with a maximum of 5 or 10 points. The total score ranges from 38 to 200, high scores indicating better function and total scores of ≤169 accepted as dysphagia.

2.4. Translation

Permission to use and translate the questionnaire was obtained from the authors (Mann-Carnaby et al.). The translation and cross-cultural adaptation of the Turkish version of the MASA was based on a previously published guideline (23). The MASA was independently translated into Turkish by three PMR specialists. After comparing all translations and making any necessary corrections, a Turkish version of the tool was created. It was then translated into English in collaboration with a professional linguist. The final Turkish MASA (T-MASA) was accepted following a comparison of the meaning and format with the original English form. During this process, a pilot study was performed with 10 patients by two PMR practitioners who were faithful to the techniques and methods defined step-by-step for the MASA test in a printed book, in order to stick to the original and prevent differences in meaning (14). The form was finalized using the obtained feedback.

2.5. Reliability

The internal consistency reliability and interrater reliability were assessed as measures of reliability. Cronbach's alpha and corrected item-to-total correlations were calculated for internal consistency. Interrater agreement between two independent raters was analyzed using the intraclass correlation coefficient (ICC). One hour between the examinations was considered to be sufficient to prevent bias, because swallowing function may change over time.

2.6. Validity

Patients were classified as 'dysphagic' and 'normal swallowing' according to their total MASA scores (≤169 and 170–200, respectively). The validity was assessed using convergent validity. Spearman's rho correlation coefficients were calculated to assess the correlations between the T-MASA and FEES.

Endoscopy was performed by an otolaryngology specialist who was blinded to the T-MASA test within the first 4 h after performing the second T-MASA test, using a 3.4-mm nonducted fiberoptic nasopharyngoscope, light source, camera, monitor, and DVD recorder (Karl Storz GmbH & Co. KG, Tuttlingen, Germany). The assessments were performed at the highest possible upright sitting position. Water was used for liquid, yoghurt for semisolid, and a cracker for solid food evaluations. Findings were recorded as video images. At the end of the examination, the presence of dysphagia was determined according to the dysphagia assessment protocol developed by Dziewas et al. (24). According to this protocol, patients were defined as 'normal swallowing' (in the absence of residue, penetration, or aspiration with fluid, semisolid, and/or solid food) or 'dysphagic'.

2.7. Statistical analysis

All statistical analyses were performed using SPSS 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were demonstrated as mean ± standard deviations for continuous variables and as a percentage for nominal variables. Internal consistency was measured using Cronbach's alpha (>0.70 indicating an acceptable value), and corrected item-to-total correlations were calculated using Spearman's rho correlation coefficients. Correlation coefficients above 0.3 were considered as acceptable (25). Interrater reliability was estimated using ICC. For the ICC results, positive values ranging from 0 to 0.2 indicate poor agreement; 0.2 to 0.4, fair agreement; 0.4 to 0.6, moderate agreement; 0.6 to 0.8, good agreement; and 0.8 to 1, very good agreement (26). For validity, Spearman's rho correlation test and receiver operating characteristic (ROC) curve analysis were used to indicate the association for dysphagia between FEES and the T-MASA. A correlation coefficient (r) was used to show the power of correlation. According to this, <0.30 indicated weak, 0.30 to 0.50 indicated moderate, 0.50 to 0.75 indicated good, and 0.75 to 1.0 indicated very good correlation between the variables (27). With the ROC curve analysis, the best diagnosis indices (sensitivity, specificity, and positive and negative predictive value [PV], as well as positive and negative likelihood ratio [LR]) were calculated. $P < 0.05$ was accepted as statistically significant.

3. Results

3.1. Patient characteristics

The mean age of the 141 patients (47 [33.3%] females, 94 [66.7%] males) included in the study was 63.27 ± 9.85 years. The mean elapsed time after stroke was 11.64 ± 5.47 days. The mean NIHSS score of patients was 9.02 ± 2.92. A total of 104 (73.8%) patients had ischemic infarcts; 37 patients (26.2%) had hemorrhagic infarcts. The demographic and disease characteristics of the patients are presented in Table 1.

The T-MASA scores evaluated by the first and second PMR specialists were 159.0 (152.18 ± 23.89) and 157.0 (151.07 ± 24.01), respectively. One hundred twenty-four (87.9%) and 127 (90.1%) of the patients had dysphagia according to the dysphagia limit determined by the T-MASA (≤169 points), respectively. With FEES, 117 (83.0%) patients had dysphagia.

Table 1. Demographic and disease characteristics of patients.

	N = 141 mean ± SD, n (%)
Age (years)	63.27 ± 9.85
Sex Female Male	 47 (33.3) 94 (66.7)
Elapsed time after stroke (days)	11.64 ± 5.47
Educational status Illiterate Under 5 years 5 years 8 years 11 years More than 11 years	 24 (17.0) 0 90 (63.8) 11 (7.8) 16 (11.4) 0
Infarct region Right Left	 83 (58.9) 58 (41.1)
NIHSS score (0–42)	9.02 ± 2.92
Brunnstrom stage (1–6) Upper extremity Hand Lower extremity	 2.53 ± 1.61 2.36 ± 1.58 2.83 ± 1.47
FIM (18–126) Cognitive score Motor score Total score	 23.75 ± 8.30 41.80 ± 21.03 65.56 ± 26.93

SD: Standard deviation; NIHSS: National Institute of Health Stroke Scale; FIM: functional independence measure.

Table 2. The mean score of items according to the raters.

Items	1st PMR, mean ± SD	2nd PMR, mean ± SD
Alertness	9.74 ± 0.66	9.72 ± 0.68
Cooperation	8.34 ± 2.66	8.37 ± 2.64
Auditory comprehension	6.12 ± 2.10	6.07 ± 2.08
Respiration	6.34 ± 2.20	6.32±2.11
Respiratory rate for swallowing	2.73 ± 1.17	2.75 ± 1.15
Dysphasia	3.63 ± 1.31	3.61 ± 1.28
Dyspraxia	3.68 ± 1.19	3.86 ± 1.17
Dysarthria	3.39 ± 1.42	3.37 ± 1.38
Saliva	4.02 ± 0.85	3.98 ± 1.12
Lip seal	3.80 ± 0.79	3.82 ± 0.68
Tongue movement	8.35 ± 1.41	8.41 ± 1.44
Tongue strength	8.18 ± 1.64	8.12 ± 1.61
Tongue coordination	7.82 ± 1.55	7.80 ± 1.67
Oral preparation	7.81 ± 1.45	7.75 ± 1.40
Gag reflex	2.53 ± 1.39	2.56 ± 1.39
Palate	6.73 ± 3.33	6.62 ± 3.25
Bolus clearance	7.78 ± 1.79	7.67 ± 1.70
Oral transit time	8.48 ± 1.67	8.29 ± 1.55
Cough reflex	2.78 ± 0.91	2.76 ± 0.82
Voluntary cough	6.12 ± 2.10	6.07 ± 2.08
Voice	6.97 ± 2.70	6.95 ± 2.64
Trache	8.97 ± 0.91	9.10 ± 0.82
Pharyngeal phase	7.98 ± 1.71	7.87 ± 1.71
Pharyngeal response	5.19 ± 3 .02	5.17 ± 3.27

SD: Standard deviation; PMR: physical medicine and rehabilitation.

3.2. Summary of T-MASA

There were no floor or ceiling effects for the total scores. Both raters gave the lowest mean scores in the presence of a gag reflex and gave the highest mean scores in the presence of alertness. The mean scores of items according to the raters are shown in Table 2. The coefficient of variation of the total T-MASA score was 15.9% for the first rater and 15.7% for the second rater as acceptable values.

3.3. Reliability

Tests performed by the first and second PMR specialists showed that the internal consistency was found to be good with Cronbach alpha values of 0.899 and 0.901, respectively. For corrected item-to-total correlation, Spearman's rho correlation coefficients ranged between 0.30 (saliva presence) and 0.86 (dysphagia) for both raters, and all of the 24 items were above the acceptable standard ($P < 0.001$). The corrected item-to-total correlation results according to the two raters are shown in Table 3; the interrater reliability of the 24 items and total T-MASA interrater scores are presented in Table 4.

In the measurements performed with ICC, the values varied from 0.910 to 0.997, suggesting satisfactory stability and very good reliability of the items. None of the items showed good, poor, or fair agreement.

3.4. Validity

A moderately negative significant correlation was found between the endoscopic evaluation and the T-MASA scores of the raters ($r = –0.324$, $P = 0.001$; $r = –0.302$, $P = 0.001$, respectively). The T-MASA scores according to the presence of dysphagia are shown in Table 5.

The total T-MASA scores for dysphagia had 96.5%–96.7% sensitivity and 83.3%–83.7% specificity. The accuracy of the test for dysphagia was 91.5%–97.2% (Figure; Table 6). The results are compatible with the

Table 3. Corrected item-to-total correlation results according to the raters.

Questions	1st PMR (r)	2nd PMR (r)
Alertness	0.497	0.490
Cooperation	0.785	0.792
Auditory comprehension	0.633	0.626
Respiration	0.396	0.400
Respiratory rate for swallowing	0.537	0.540
Dysphasia	0.863	0.863
Dyspraxia	0.774	0.784
Dysarthria	0.784	0.769
Saliva	0.306	0.304
Lip seal	0.367	0.361
Tongue movement	0.527	0.509
Tongue strength	0.337	0.323
Tongue coordination	0.633	0.626
Oral preparation	0.762	0.779
Gag reflex	0.451	0.460
Palate	0.366	0.386
Bolus clearance	0.606	0.549
Oral transit time	0.554	0.565
Cough reflex	0.369	0.362
Voluntary cough	0.336	0.331
Voice	0.839	0.835
Trache	0.309	0.314
Pharyngeal phase	0.598	0.604
Pharyngeal response	0.714	0.722

PMR: Physical medicine and rehabilitation; r: correlation coefficient.

usefulness of the T-MASA for diagnostic accuracy of dysphagia.

4. Discussion

There are a variety of methods and guidelines for the diagnosis of dysphagia, but no consensus exists on a standard method of assessment. However, a fairly strong consensus in most guidelines is to use a bedside screening test as a first step in the diagnostic process (7,28). The current stroke guidelines recommend bedside dysphagia screening tests before starting oral intake; evaluation should be supported by FEES or VF (7,28).

First, a good screening test should be valid and reliable; that is, it must be able to determine the need for further evaluation of dysphagia, and similar results should be obtained when different raters use the test. It should also have high sensitivity and specificity, and a high positive LR or low negative LR for distinguishing healthy individuals and those with dysphagia. In addition, the test should be cost-effective and minimally invasive, as well as easy to apply and to teach (10,28–30).

The MASA was developed as a bedside dysphagia screening test for patients with stroke by Mann et al. (13,14). The test has been validated against VF evaluation and its interrater reliability has been demonstrated. It is a physician-based test; cut-off values have been created to define aspiration and dysphagia risk. A total MASA score of 178 or above is considered to be the cut-off value for the absence of dysphagia, as in our study.

Unlike other screening tests, the MASA is used to evaluate consciousness, because the correlation between consciousness and dysphagia has been shown in literature (31). Moreover, the MASA includes a detailed examination involving the oral phase and symptoms reported such as dysarthria as the most important predictors of oral dysphagia, which is another difference from other tests

Table 4. Interrater reliability results of 24 items and total T-MASA scores.

Questions	ICC (95% CI)	P
Alertness	0.995 (0.878–0.997)	0.001
Cooperation	0.967 (0.754–0.996)	0.001
Auditory comprehension	0.996 (0.861–0.998)	0.001
Respiration	0.996 (0.811–0.998)	0.001
Respiratory rate for swallowing	0.992 (0.727–0.998)	0.001
Dysphasia	0.995 (0.871–0.996)	0.001
Dyspraxia	0.910 (0.646–0.989)	0.001
Dysarthria	0.936 (0.753–0.993)	0.001
Saliva	0.973 (0.726–0.991)	0.001
Lip seal	0.997 (0.882–0.998)	0.001
Tongue movement	0.996 (0.861–0.998)	0.001
Tongue strength	0.977 (0.834–0.988)	0.001
Tongue coordination	0.996 (0.855–0.998)	0.001
Oral preparation	0.973 (0.786–0.989)	0.001
Gag reflex	0.993 (0.850–0.996)	0.001
Palate	0.990 (0.862–0.995)	0.001
Bolus clearance	0.966 (0.841–0.996)	0.001
Oral transit time	0.992 (0.805–0.996)	0.001
Cough reflex	0.935 (0.646–0.952)	0.001
Voluntary cough	0.987 (0.814–0.994)	0.001
Voice	0.997 (0.829–0.998)	0.001
Trache	0.989 (0.812–0.993)	0.001
Pharyngeal phase	0.993 (0.742–0.996)	0.001
Pharyngeal response	0.967 (0.728–0.988)	0.001
Total T-MASA score	0.997 (0.880–0.998)	0.001

PMR: Physical medicine and rehabilitation; ICC: intraclass correlation coefficient; CI: confidence interval; T-MASA: Turkish version of Mann Assessment Swallowing Ability.

Table 5. The T-MASA scores according to presence of dysphagia as determined using FEES.

	Normal mean ± SD	Dysphagia mean ± SD	P
Total T-MASA score (1st rater)	167.49 ± 24.23	130.79 ± 21.49	0.001
Total T-MASA score (2nd rater)	164.16 ± 24.44	132.71 ± 20.95	0.001

SD: Standard deviation; T-MASA: Turkish version of Mann Assessment Swallowing Ability; FEES: flexible fiberoptic endoscopic evaluation of swallowing.

(32). In addition, studies have shown that the MASA is a comparable test in validity studies (19,33). We chose this test because of the lack of a physician-based, formal, validated test for the detailed evaluation of swallowing function in our country.

The results of our study show that the internal consistency of the test was at a good level. The test also showed very good interrater reliability. The correlation of the test scores and the presence of dysphagia using FEES showed there was a moderate negative correlation. The

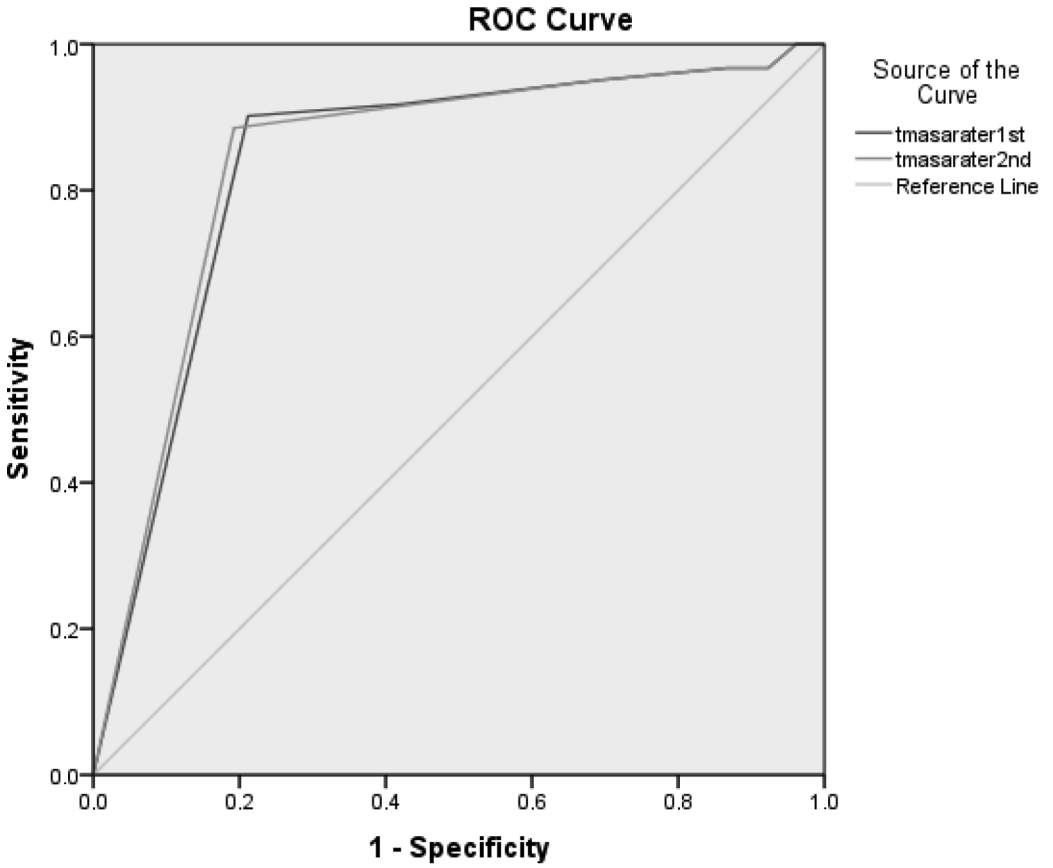

Figure. ROC analysis.

Table 6. ROC analysis results.

	Sensitivity (95% CI)	Specificity (95% CI)	+PV (95% CI)	–PV (95% CI)	+LR (95% CI)	–LR (95% CI)
1st rater	96.5 (84.7–97.3)	83.3 (74.6–87.3)	98 (87.8–98.9)	65 (43.1–67.2)	5.64 (3.1–6.1)	0.47 (0.3–0.6)
2nd rater	96.7 (90.1–97.5)	83.7 (76.8–87.3)	97 (89.4–98.6)	65 (42.9–66.9)	5.62 (2.8–5.9)	0.48 (0.2–0.5)

ROC: Receiver operating characteristic; CI: confidence interval; PV: predictive value; LR: likelihood ratio.

sensitivity of the test was 96.5%–96.7%, the specificity was 83.3%–83.7%, and the overall accuracy was 91.5%–97.2%.

In Mann et al.'s MASA design study (13,14), interrater reliability was assessed in 128 patients with acute stroke with a mean elapsed time of 3 days and validated with VF with a mean elapsed time of 10 days. They reported good internal consistency and almost perfect interrater reliability. The test had 89% sensitivity and 73% specificity, and high PV and LR scores when validated with VF. These results are similar to the results in our study, but our results seem somewhat better in terms of sensitivity and specificity. This may be due to the FEES method we used and the application time of the test. In Mann et al.'s study, the questionnaire was administered in a mean of 3 days, whereas the VF evaluation was performed in a mean of 10 days. Dysphagia may improve spontaneously by 70%–80% in the early period following a stroke. Therefore, some patients may have recovered prior to the VF evaluation. In addition, unlike the study of Mann et al., we used the FEES as a comparison method for validity. Techniques

such as VF and FEES are a one-time, unrealistic view of a patient's swallowing ability within an unnatural setting. Compliance with VF is much more difficult than with FEES in this early stroke period, particularly when cognitive impairment is more pronounced. FEES can be performed at the bedside without requiring the patient to move, be transported, or require head positioning, as in our study. In addition, in recent studies with different patient groups, the MASA was found to be more reliable compared with VF scores in terms of dysphagia scores (17).

In the abstract published by Vanderwegen et al. (18), 96% sensitivity and 75% specificity with FEES in 54 patients within a mean of 36 h after their stroke was reported. In our study, patients with a mean duration of 11.5 days were sampled. The reason for lower specificity in Vanderwegen et al.'s study and the lesser ability to distinguish healthy people who are correctly identified as not having dysphagia may be that cognitive dysfunction and motor disability associated with the oral phase may be higher in the very early period after a stroke.

In the study by Oh et al. (19), in which the reliability and validity of the MASA were studied, the interrater reliability rate in 19 of 54 patients was very good, which is similar to the rate found in our study. However, they validated against VF and reported a good correlation, which is incompatible with the results of our study. In their study, VF was applied to 54 patients, whereas the reliability study was applied to 19 patients and the test–retest process was applied to only 10 patients. Moreover, Oh et al. included patients with chronic stroke (mean duration: 10.9 months); thus, it is difficult to compare the results.

In conclusion, the MASA is an evaluation tool that has high specificity and sensitivity as well as good internal consistency and interrater reliability values. The present study shows that the T-MASA is a valid and reliable scale for Turkish patients in the early period after a stroke.

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