Available online at www.medicinescience.org

ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2025;14(1):119-26

Evaluation of digestive symptoms in patients with systemic sclerosis: A cross-sectional study

Hatice Ecem Konak[1], Gulsah Soyturk[1], Ebru Atalar[1], Serdar Can Guven[1], Pinar Akyuz Dagli[1], Esra Kayacan Erdogan[1], Hakan Babaoglu[1], Berkan Armagan[1], Ismail Dogan[2], Yuksel Maras[3], Ahmet Omma[3], Sukran Erten[2], Kevser Orhan[1]

[1]Ankara Bilkent City Hospital, Department of Rheumatology, Ankara, Türkiye
[2]Yıldırım Beyazıt University, Department of Internal Medicine, Division of Rheumatology, Ankara, Türkiye
[3]University of Health Sciences, Ankara City Hospital, Division of Rheumatology, Ankara, Türkiye

Received 04 December 2024; Accepted 02 January 2025
Available online 01 March 2025 with doi: 10.5455/medscience.2024.12.156

Abstract

In systemic sclerosis (SSc), the gastrointestinal (GI) system is the most frequently affected internal organ system, with involvement extending from the mouth to the anus. The aim of this study was to define GI involvement and malnutrition risk in SSc patients and to investigate the relationship of GI with other SSc-related organ pathologies. This single-center, observational cross-sectional study included patients with SSc according to the 2013 criteria of the American College of Rheumatology/European League Against Rheumatism, and healthy volunteers. The severity of gastrointestinal symptoms was assessed with the University of California, Los Angeles Scleroderma Clinical Trials Consortium Gastrointestinal Tract 2.0 (UCLA SCTC GIT 2.0), dysphagia with the Eating Assessment Tool-10 (EAT-10), and nutritional status with the Mini Nutritional Assessment Short Form (MNA-SF) questionnaire. The study included 93 SSc patients and 71 controls. According to the UCLA SCTC GIT 2.0 questionnaire of SSc patients, the severity of digestive system symptoms was mild. UCLA SCTC GIT 2.0 total score, reflux, abdominal distension, social functioning, emotional well-being symptom scores were statistically higher in the patient group than in the control group. Dysphagia symptoms and malnutrition were more common in SSc patients compared to the control group ($p<0.001$, $p<0.001$ respectively). Modified Rodnan skin score (mRSS)>10 was shown to be associated factors with UCLA-total, mRSS>10 and interstitial lung disease with EAT-10, and mRSS>10 and dyspnea with MNA-SF. conclusion, GI symptoms are frequently seen in SSc patients and may result in many complications ranging from impaired quality of life to death. It is important to evaluate and increase awareness of risk factors associated with GI disorders, dysphagia and malnutrition in SSc patients.

Keywords: Dysphagia, systemic sclerosis, gastrointestinal involvement

Introduction

Vascular dysfunction and fibrosis are hallmarks of systemic sclerosis (SSc), an autoimmune connective tissue disease [1]. The pathogenesis of SSc is uncertain, however it is thought to be caused by an early vascular lesion that results in intestinal permeability changes, neurological dysfunction, fibrosis, and loss of function [2]. The most frequently impacted internal organ system in SSc is the gastrointestinal (GI) system, which can affect any area from the mouth to the anuS [3]. In over 90% of cases, gastrointestinal disorders were reported [4]. The most prevalent GI disorder is gastroesophageal reflux disease (GER), with serious complications including esophagitis, Barrett's esophagus, bleeding associated with vascular dysplasia, and toxic megacolon [5]. Other frequently reported symptoms are anorectal symptoms such as gastroparesis, nausea, bloating, abdominal pain, constipation, diarrhea, and anal incontinence. Oropharyngeal dysphagia may result from pharyngeal muscular atrophy and fibrosis, while esophageal dysmotility may be

CITATION
Konak HE, Soyturk G, Atalar E, et al. Evaluation of digestive symptoms in patients with systemic sclerosis: A cross-sectional study. Med Science. 2025;14(1):119-26.

Corresponding Author: Hatice Ecem Konak, Ankara Bilkent City Hospital, Department of Rheumatology, Ankara, Türkiye
Email: haticeecemkonak@gmail.com

DOI: 10.5455/medscience.2024.12.156

induced by injury to the esophageal smooth muscles brought on by ischemia and inflammatory causes [5]. GI involvement considerably increases morbidity and death because it can cause malnutrition, a lower quality of life, and major problems from microaspiration. Therefore, early diagnosis of GI involvement is critical.

Since GI dysfunction symptoms in SSc can be caused by organ damage or side effects from medication, evaluating them is challenging and complex. Recently used to assess the GI tract, the University of California, Los Angeles Scleroderma Clinical Trials Consortium Gastrointestinal Tract 2.0 (UCLA SCTC GIT 2.0) test provides a straightforward assessment with proven validity and reliability [6]. The 'Eating Assessment Tool-10' (EAT-10) questionnaire used to detect swallowing disorders is a symptom-specific research tool applied by the individual [7]. Also, a useful tool for assessing a person's nutritional status is the Mini Nutritional Assessment Short Form (MNA-SF) [8].

The aim of this study was to define gastrointestinal involvement and malnutrition risk in SSc patients utilizing UCLA SCTC GIT 2.0, EAT-10, and MNA-SF, as well as to look into the association between gastrointestinal symptoms and socioeconomic, clinical, laboratory, and other SSc related organ diseases.

Material and Methods

This study is a single-center, observational cross-sectional study. Patients who applied to Ankara Bilkent City Hospital Rheumatology Clinic and were diagnosed with systemic sclerosis according to the 2013 criteria of the American College of Rheumatology/European League Against Rheumatism [9] were included in the study. Those under the age of 18, pregnant women, and patients with malignancy, active infection, and inflammatory gastrointestinal diseases and overlap connective tissue disease were excluded from the study. Age- and gender-matched healthy volunteers who did not have any diseases that would affect swallowing and the gastrointestinal system were included to form the control group. Demographics, body mass index, socioeconomic characteristics, and comorbidities of all participants in the control and SSc patient groups were recorded. The relevant clinical features, initial symptoms, disease duration, laboratory findings, and organ involvements of SSc patients were noted. The modified Rodnan skin score (mRSS) was used to gauge the degree of skin fibrosis [10].

The severity of gastrointestinal symptoms was evaluated using the UCLA SCTC GIT 2.0, which has 34 questions broken down into 7 subscales (social functioning, emotional well-being, diarrhea, stool soiling, constipation, reflux, and distension/bloating) [6]. The UCLA-total score was calculated by considering all factors other than constipation. A general score for the patient's GI health and symptom intensity was obtained from the questionnaire; scores ranged from mild, moderate, severe, or extremely severe to no gastrointestinal involvement. The Turkish validation of UCLA SCTC GIT 2.0 form was used [11].

The assessment of dysphagia, or dangerous swallowing, was conducted using the EAT-10 questionnaire. It comprises of ten questions aimed at identifying swallowing issues and assessing how they affect quality of life. Patients assess each question from 0 to 4, with a score of ≥3 suggesting dysphagia (difficulty swallowing effectively and safely) [7]. The Turkish validation of EAT-10 form was used [12].

A brief questionnaire measuring nutritional status, the MNA-SF includes six questions about disease, psychological stress, mobility, food intake, and weight loss. A total score between 0 (worst) and 14 (highest) is assigned. Three categories are used to classify nutrition scores: malnutrition (0–7 points), malnutrition risk (8–11 points), and normal (>11 points) [8].

All control and patient group participants in the study were evaluated using UCLA SCTC GIT 2.0, MNA-SF and EAT-10, This study was carried out in compliance with the principles of the Declaration of Helsinki and was approved by the Ankara City Hospital Ethics Committee (TABED 2-24-437).

Statistical Analysis

Every participant in the SSc and control groups underwent descriptive analysis. The frequency of qualitative variables was quantified using the number of observations and the percentage. Quantitative data were reported as mean±SD for normal distribution and median and percentiles 25 and 75 (p25-p75) for non-normal distributions. To determine if the distribution of continuous variables was normal, the Kolmogorov-Smirnov test was employed. The x^2 test was used to compare categorical variables. Depending on normality, continuous variables were compared using the Mann-Whitney-U test or the student-t test. Spearman's Rho was utilized to assess correlations between variables. The UCLA SCTC GIT 2.0, MNA-SF and EAT-10 tests were examined for predicting indicators for the presence of changes using binary logistic regression analysis. In terms of statistics, p values less than 0.05 were deemed significant.

Results

The study involved 93 SSc patients and 71 controls. The mean age of SSc patients was 55±11.72, while the control group was 53.22±10. In both groups, female patients made up the majority. Examining the patient and control groups revealed no statistically significant differences in their demographic traits. 41.9% of SSc patients had limited, while 58.1% had diffuse type SSc. The mean disease duration was 8 (5-14) (median (p25-p75)) years. Raynaud phenomenon was the most prevalent initial complaint (45.2%), followed by arthritis or arthralgia (25.8%). The most common symptoms other than digestive symptoms were Raynaud's phenomenon (94.6%) and dyspnea (60.2%). Table 1 shows the demographic, clinical, and laboratory features of SSc patients as well as the control group.

DOI: 10.5455/medscience.2024.12.156

Table 1. Clinical, demographic and laboratory characteristics of SSc and control group

	Systemic sclerosis group (n=93)	Control group (n=71)	p
Age,years, mean±SD	55±11.72	53.22±10	0.308
Female, n (%)	91 (97.8)	66 (93)	0.125
BMI, mean±SD	25.69±3.93	25.15±3.27	0.353
Smoking,ever, n (%)	25 (26.9)	13 (18.3)	0.197
Educational level, n (%)			
No formal study	6 (6.5)	7 (9.9)	
Primary school	33 (35.5)	35 (49.3)	
Secondary school	20 (21.5)	10 (14.1)	0.203
High school	22 (23.7)	15 (21.1)	
University	12 (12)	4 (5.6)	
Marital status, n (%)			
Single	5 (5.4)	3 (4.2)	
Married	77 (82.8)	65 (91.5)	0.203
Widow	11 (11.8)	3 (4.2)	
Comorbid conditions, n (%)			
Hypertension	57 (61.3)	20 (28.2)	0.00
Diabetes mellitus	5 (5.4)	2 (2.8)	0.700
Coronary artery disease	9 (9.7)	2 (2.8)	0.116
Asthma/COPD	9 (9.7)	2 (2.8)	0.116
Chronic kidney disease	3 (3.2)	0 (0)	0.259
Disease duration, years, median (p25-p75)	8 (5-14)		
SSc type, n (%)			
Limited	39 (41.9)		
Diffuse	54 (58.1)		
First symptom, n (%)			
Raynaud	42 (45.2)		
Arthralgia/arthritis	24 (25.8)		
Dyspnea	14 (15.2)		
Digital ulcers	7 (7.5)		
Skin hardness	6 (6.5)		
Raynaud, n (%)	88 (94.6)		
Dyspnea, n (%)	56 (60.2)		
Digital ulcers, n (%)	37 (39.8)		
ILD, n (%)	45 (48.4)		
PAH, n (%)	15 (16.1)		
mRSS, median (p25-p75)	12 (5-20)		
Laboratory data, n (%)			
ANA	91 (97.8)		
Anticentromere	30 (32.3)		
Anti-Scl-70	48 (51.6)		
Anti-RNA polymerase III	10 (10.8)		

ANA: antinuclear antibodies, BMI: body mass index, COPD: chronic obstructive pulmonary disease, ILD: Interstitial lung disease, mRSS: modified Rodnan skin score, PAH: Pulmonary hypertension, SSc:systemic sclerosis

Gastrointestinal Involvement, Dysphagia and Malnutrition

In terms of gastrointestinal symptoms, Table 2 contrasts the traits of SSc patients and controls. The UCLA SCTC GIT 2.0 questionnaire of SSc patients revealed that gastrointestinal symptoms were mild (median (p25-p75) 0.35 (0.15-0.61). The abdominal distension scores were the highest (median (IQR) 0.75 (0.50-1.25) and reflux (median (IQR) 0.62 (0.25-0.88).

DOI: 10.5455/medscience.2024.12.156

Gastrointestinal problems had a minor impact on patients' social functioning and emotional well-being. The patient group had significantly higher UCLA SCTC GIT 2.0 total score, reflux, abdominal distension, social functioning, and emotional well-being symptom scores than the control group (p<0.001, p<0.001, p<0.001, p=0.01, respectively).

Table 2. Comparison of digestive system involvement characteristics of SSc and control group

	Systemic sclerosis group (n=93)	Control group (n=71)	p
UCLA total, median (p25-p75)	0.35 (0.15-0.61)	0.16 (0.04-0.26)	<0.001
None or mild, n (%)	58 (62.4)	67 (94.4)	
Moderate, n (%)	30 (32.3)	4 (5.6)	<0.001
Severe or very severe, n (%)	5 (5.4)	0 (0)	
Reflux, median (p25-p75)	0.62 (0.25-0.88)	0.25 (0.0-0.50)	<0.001
None or mild, n (%)	30 (32.3)	47 (66.2)	
Moderate, n (%)	41 (44.1)	23 (32.4)	<0.001
Severe or very severe, n (%)	22 (23.7)	1 (1.4)	
Abdominal distension, median (p25-p75)	0.75 (0.50-1.25)	0.50 (0.25-0.75)	<0.001
None or mild, n (%)	66 (71)	69 (97.2)	
Moderate, n (%)	12 (12.9)	0 (0)	<0.001
Severe or very severe, n (%)	15 (16.1)	2 (2.8)	
Faecal soilage, median (p25-p75)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.30
None or mild, n (%)	92 (98.9)	71 (100)	
Moderate, n (%)	1 (1.1)	0 (0)	0.381
Severe or very severe, n (%)	0 (0)	0 (0)	
Diarrhoea, median (p25-p75)	0.00 (0.0-0.025)	0.00 (0.0-0.0)	0.440
None or mild, n (%)	70 (75.3)	56 (78.9)	
Moderate, n (%)	18 (19.4)	15 (19.4)	0.139
Severe or very severe, n (%)	5 (5.4)	0 (0)	
Constipation, median (p25-p75)	0.25 (0.0-0.75)	0.00 (0.0-0.50)	0.372
None or mild, n (%)	53 (57.9)	42 (59.2)	
Moderate, n (%)	36 (38.7)	29 (40.8)	0.209
Severe or very severe, n (%)	4 (4.3)	0 (0)	
Social functioning, median (p25-p75)	0.33 (0.0-0.66)	0.00 (0.0-0.16)	<0.001
None or mild, n (%)	48 (51.6)	64 (90.1)	
Moderate, n (%)	43 (46.2)	7 (9.9)	<0.001
Severe or very severe, n (%)	2 (2.2)	0 (0)	
Emotional well-being, median (p25-p75)	0.22 (0.0-0.55)	0.00 (0.0-0.22)	0.01
None or mild, n (%)	64 (68.8)	65 (91.5)	
Moderate, n (%)	27 (29)	6 (8.5)	0.02
Severe or very severe, n (%)	2 (2.2)	0 (0)	
EAT-10, median (p25-p75)	3 (0.0-10)	0.00 (0.0-0.0)	<0.001
Dysphagia (EAT ≥3), n (%)	57 (61.3)	9 (12.7)	<0.001
No dysphagia (EAT<3), n (%)	36 (38.7)	62 (87.3)	
MNA-SF, median (p25-p75)	12 (9.5-12)	14 (13-14)	<0.001
Normal (>11 points), n (%)	55 (59.1)	71 (100)	
Risk of malnutrition (8–11 points), n (%)	29 (31.2)	0 (0)	<0.001
Malnutrition (0–7 points), n (%)	9 (9.7)	0 (0)	

EAT-10: Eating Assessment Tool-10, MNA-SF: Mini Nutritional Assessment Short Form, UCLA: University of California, Los Angeles Scleroderma Clinical Trials Consortium Gastrointestinal Tract 2.0

DOI: 10.5455/medscience.2024.12.156

Patients with moderate and severe or very severe gastrointestinal symptoms were significantly more likely to have diffuse type SSc, higher mRSS, interstitial lung disease (ILD), pulmonary hypertension (PHT), and older age when SSc patients were compared based on the UCLA SCTC GIT 2.0 total score involvement severity (Table 3).

61.3% of SSc patients reported difficulties swallowing (EAT-10 score≥3). Dysphagia were more common in SSc patients than in controls (p=0.00) (Table 2). Patients with dysphagia were more likely to have ILD and PHT, and they also had greater mRSS, diffuse type SSc, and longer disease duration (Table 3).

Table 3. Comparison of clinical and demographic features of SS patients according to UCLA-total, EAT-10 and MNA-SF

	UCLA-total		p	EAT-10		p	MNA-SF		p
	None of mild	Moderate severe or very severe		No dysphagia	Dysphagia		Normal	Risk of malnutrition or malnutrition	
Age,years, mean±SD	53.29±12.30	58.15±10.31	**0.045**	49.62±9.97	51.66±16.01	0.734	52.09±12.29	59.21±9.5	**0.007**
Female, n (%)	57 (98.3)	38 (97.4)	0.775	93 (94.9)	64 (97)	0.520	59 (100)	36 (94.7)	0.075
Smoking, ever, n (%)	13 (22.4)	12 (30.8)	0.356	20 (20.4)	18 (27.3)	0.307	16 (27.1)	9 (23.7)	0.706
Disease duration, years, median (p25-p75)	6 (4-13)	10 (7-15)	0.068	6 (4-10)	10 (6-15)	**0.006**	6 (4-11.5)	10 (7-15)	**0.012**
SSc type, n (%)									
Limited	31 (53.4)	8 (22.9)	**0.004**	24 (66.7)	15 (26.3)	**<0.001**	29 (52.7)	10 (26.3)	**0.011**
Diffuse	27 (46.6)	27 (77.1)		12 (33.3)	42 (73.7)		26 (47.3)	28 (73.7)	
Raynaud, n (%)	54 (93.1)	34 (97.1)	0.403	34 (94.4)	54 (94.7)	0.951	51 (92.7)	37 (97.4)	0.329
Dsypnea, n (%)	28 (48.3)	28 (80)	**0.002**	14 (38.9)	42 (73.7)	**0.001**	25 (45.5)	31 (81.6)	**<0.001**
Digital ulcers, n(%)	18 (31)	19 (54.3)	**0.026**	12 (33.3)	25 (43.9)	0.312	16 (29.1)2	21 (55.3)	**0.011**
ILD, n (%)	21 (36.2)	24 (68.6)	**0.002**	8 (22.2)	37 (64.9)	**0.000**	20 (36.4)	25 (65.8)	**0.005**
PAH,n (%)	4 (6.9)	11 (31.4)	**0.002**	2 (5.6)	13 (22.8)	**0.041**	4 (7.3)	11 (28.9)	**0.009**
mRSS, median (p25-p75)	6 (3-18)	20 (16-23.5)	**<0.001**	5.5 (2-10)	18 (10-22)	**<0.001**	6 (4-15.5)	20 (15-24)	**<0.001**

EAT-10: Eating Assessment Tool-10, ILD: interstitial lung disease, MNA-SF: Mini Nutritional Assessment Short Form, mRSS: modified Rodnan skin score, PAH: pulmonary hypertension, SSc: systemic sclerosis, UCLA: University of California, Los Angeles Scleroderma Clinical Trials Consortium Gastrointestinal Tract 2.0

In comparison to the control group, there was a statistically significant difference (p=0.00) between the 9.7% of SSc patients who were malnourished and the 31.2% who were at risk of malnutrition, according to MNA-SF, which measures malnutrition (Table 2). Malnutrition risk and malnutrition were associated with longer disease duration, older age, diffusely involved type, and higher modified skin score, with ILD and PHT being detected more frequently (Table 3).

Factors with significant difference in Table 3 were assessed by a binary logistic regression model. mRSS>10 was shown as factors associated with UCLA-total, mRSS>10 and ILD was shown as factors associated with EAT-10, mRSS>10 and dyspnea was shown as factors associated with MNA-SF (Table 4). The MNA-SF questionnaire, EAT-10, and UCLA total score all showed a positive correlation (Table 5).

Table 4. Factors significantly associated with UCLA-total, EAT-10 and MNA-SF according to logistic regression analysis

Predictive factors for UCLA-total impairment			
Factor	**OR**	**95% [CI]**	**p**
mRSS≥10	9.818	3.317–29.062	<0.001
Predictive factors for EAT-10 impairment			
Factor	**OR**	**95% [CI]**	**p**
mRSS≥10	6.504	2.356–17.957	<0.001
ILD	4.083	1.437–11.598	0.008
Predictive factors for MNA-SF impairment			
Factor	**OR**	**95% [CI]**	**p**
mRSS≥10	4.947	1.748–14.001	0.003
Dyspnea	3.112	1.078–9.043	0.036

ILD: interstitial lung disease, mRSS: modified Rodnan skin score

DOI: 10.5455/medscience.2024.12.156

Table 5. Correlation of UCLA-total, EAT-10, and MNA-SF questionnaires

r (p)	UCLA-total	EAT-10	MNA-SF
Age	**0.374 (p<0.001)**	**0.418 (p<0.001)**	**0.398 (p<0.001)**
Gender	0.032 (p=0.688)	0.072 (p=0.361)	0.079 (p=0.316)
Smoking	**0.178 (p=0.023)**	0.071 (p=0.366)	0.041 (p=0.605)
BMI	0.018 (p=0.820)	0.001 (p=0.994)	0.021 (p=0.785)
Disease duration	**0.305 (p=0.003)**	**0.255 (p=0.014)**	**0.272 (p=0.008)**
SSc type	**0.391 (p<0.001)**	**0.372 (p<0.001)**	**0.311 (p=0.002)**
mRSS	**0.515 (p<0.001)**	**0.559 (p<0.001)**	**0.525 (p<0.001)**
PAH	**0.327 (p=0.001)**	**0.280 (p=0.007)**	**0.265 (p=0.010)**
ILD	**0.344 (p=0.001)**	**0.383 (p<0.001)**	**0.313 (p=0.002)**
Anticentromere	**0.361 (p<0.001)**	**0.402 (p<0.001)**	**0.323 (p=0.002)**
Anti-Scl-70	**0.280 (p=0.007)**	**0.349 (p=0.001)**	**0.228 (p=0.028)**
EAT-10	**0.815 (p<0.001)**		
MNA-SF	**0.757 (p<0.001)**		

BMI: body mass index, EAT-10: Eating Assessment Tool-10, ILD: interstitial lung disease, MNA-SF: Mini Nutritional Assessment Short Form, mRSS: modified Rodnan skin score, PAH: pulmonary hypertension, SSc: systemic sclerosis, UCLA: University of California, Los Angeles Scleroderma Clinical Trials Consortium Gastrointestinal Tract 2.0

Discussion

In the study, 37% of SSc patients had moderate to severe gastrointestinal dysfunction. The most commonly affected subscales were abdominal distension and GER. According to EAT-10, dysphagia was reported by more than %50 of the patients. Forty percent were determined to be malnourished or at risk of malnutrition based on the MNA-SF. UCLA total score, EAT-10, and MNA-SF scores all showed a positive correlation with advanced age, extended disease duration, diffusely type SSc, advanced skin stiffness, ILD and PAH. In accordance with regression analysis, mRSS>10 was identified as the related factor for EAT-10 in all three questionnaires.

Data from the UCLA SCTC GIT 2.0 instrument revealed mild GI symptoms in SSc patients (median (IQR) 0.35 (0.15-0.61)). 37% of patients had moderate or severe symptoms. These results are lower than previous studies [13,14]. The most commonly affected subscales in the UCLA SCTC GIT 2.0 were abdominal distension and gastroesophageal reflux. GER was moderate or severe in 63% of individuals. Early esophageal involvement brought on by neuronal dysfunction and smooth muscle atrophy, followed by fibrosis within the muscular propria, is part of the pathophysiology of GER. The early detection of GER in SSc patients is critical. Such anomalies may cause esophagitis, gastritis, opportunistic infections, Barrett's esophagus, and cancer [15]. Studies have indicated a connection between interstitial lung disease and microaspiration brought on by esophageal reflux [16-18]. Long-term exposure of the lung epithelium to stomach contents is believed to enhance airway epithelial cell fibrosis and fibroblast development, while the precise pathophysiology of this link is unclear [17].

The EAT-10 questionnaire is frequently employed as the first assessment instrument to identify swallowing issues. In the study, swallowing disorders were found in 61.3% of the patients. This outcome is comparable to one from another study. Approximately 60% of patients with SSc have been reported to have dysphagia awareness [19]. In those with SSc, xerostomia affects the oral phase of swallowing, and over half of them experience issues with the pharyngeal phase [20,21]. Swallowing dysfunction in SSc is caused by a variety of factors, including neuropathy-induced oropharyngeal muscle failure, muscular fibrosis brought on by tissue hypoxia brought on by vascular damage and atrophy, and fibrosis of the pharyngeal constrictors and anterior cervical muscles used for swallowing movements [20,21].

The MNA-SF questionnaire, EAT-10, and UCLA total score all showed a positive correlation. This result is similar to the previous study investigating the relationship between dysphagia and malnutrition [10]. Of the patients, 9.7% experienced malnutrition, while 31.2% were at risk for it. Due to limited mouth opening, dysphagia, and involvement of the GI system, SSc patients are susceptible to malnutrition. Malnutrition can cause more aggressive disease, a large burden in terms of morbidity and potential consequences, as well as a negative influence on mortality [22]. Despite the fact that malnutrition-related mortality have decreased due to improvements in nutritional support, it still accounts for approximately 4% of SSc deaths [23]. Therefore, evaluation of nutritional status is very important to prevent morbidity and mortality.

According to the multivariate analysis, patients with mRSS>10 had more gastrointestinal symptoms, difficulty swallowing, and malnutrition. According to previous studies, skin involvement is a significant predictor of SSc severity, activity, and prognosis as well as an independent cause of death [24]. Immune cell infiltration with B and T cells causes fibrosis in patients' skin, and B cells in particular are believed to be linked to poorer skin

DOI: 10.5455/medscience.2024.12.156

development in the early stages. Multiple tissues may be targeted by these immunological diseases, resulting in the concurrent involvement of other organs, such as the gastrointestinal tract, in addition to the skin [25,26]. Esophageal motility abnormalities on imaging tests like manometry and gammagraphy have previously shown a direct correlation between the degree of gastrointestinal involvement and mRSS [27,28]. Additionally, a study discovered that individuals with SSc and substantial skin involvement have gastrointestinal symptoms early and more frequently [29].

Results from research on systemic sclerosis patients point to a link between interstitial lung disease and microaspiration brought on by esophageal reflux [30-33]. Although the microaspiration theory explains this situation, it is also possible that esophageal disease and ILD occur in parallel as a consequence of the progressive fibrotic process of the disease and that a more severe SSc phenotype is a marker for ILD. In our study, symptoms of GI dysfunction, dysphagia and malnutrition were detected more frequently in patients at risk for ILD. According to regression analysis, the presence of ILD was shown to be a factor associated with dysphagia. However, the cross-sectional nature of this study and previous investigations makes it unclear if the findings represent a true cause-and-effect link between esophageal involvement and the existence and severity of SSc-ILD.

There were some limitations in our study. Many data analyzed through the questionnaire are based on subjective symptoms and these symptoms fluctuate over time. The collection of data through a questionnaire may create a bias. In addition, GI system symptoms and swallowing-related symptoms were not supported by imaging methods. Despite this, the data obtained from our study provide important information about how symptoms are perceived and how they affect quality of life. Finally, our study's data is limited because it was conducted with a single center and a small number of patients, despite the fact that they were from a rare disease category.

Conclusion

In conclusion, our study provides important data regarding GI system symptoms in SSc patients. GI dysfunctions are commonly encountered in SSc patients and may result in several problems ranging from decreased quality of life to death. It is critical to assess the risk factors linked with GI problems, dysphagia, and malnutrition in SSc patients and to raise awareness.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
The study was conducted in compliance with the Helsinki Declaration and approved by the Mustafa Kemal University Ethics Committee (Approval No: 08/06/2024-46).

References

1. Gu YS, Kong J, Cheema GS, et al. The immunobiology of systemic sclerosis. Seminars in arthritis and rheumatism. 2008;38:132-60.
2. Howe S, Eaker EY, Sallustio JE, et al. Antimyenteric neuronal antibodies in scleroderma. J Clin Invest. 1994;94:761-70.
3. Ebert EC. Gastric and enteric involvement in progressive systemic sclerosis. J Clin Gastroenterol. 2008;42:5-12.
4. Sjogren RW. Gastrointestinal features of scleroderma. Curr Opin Rheumatol. 1996;8:569-75.
5. Li B, Yan J, Pu J, et al. Esophageal dysfunction in systemic sclerosis: an update. Rheumatol Ther. 2021;8:1535-49.
6. Khanna D, Hays RD, Maranian P, et al. Reliability and validity of the University of California, Los Angeles Scleroderma Clinical Trial Consortium Gastrointestinal Tract Instrument. Arthritis Rheum. 2009;61:1257-63.
7. Demir N, Serel Arslan S, İnal Ö, Karaduman AA. Reliability and Validity of the Turkish Eating Assessment Tool (T-EAT-10). Dysphagia. 2016;31:644-9.
8. Rubenstein LZ, Harker JO, Salvà A, et al. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). J Gerontol A Biol Sci Med Sci. 2001;56:M366-72.
9. van den Hoogen F, Khanna D, Fransen J, et al. 2013 classification criteria for systemic sclerosis: an American College of Rheumatology/European League against Rheumatism collaborative initiative. Arthritis Rheum. 2013;65:2737-47.
10. Khanna D, Furst DE, Clements PJ, et al. Standardization of the modified Rodnan skin score for use in clinical trials of systemic sclerosis. J Scleroderma Relat Disord. 2017;2:11-8.
11. Tas YM, Dervis Hakim G, Keskinoglu P, et al. The validity and reliability study of the University of California, Los Angeles Scleroderma Clinical Trial Consortium Gastrointestinal Tract (UCLA SCTC GIT) 2.0 questionnaire for the Turkish society. Turk J Gastroenterol. 2019;30:234-41.
12. Demir N, Serel Arslan S, Inal O, Karaduman AA. Reliability and Validity of the Turkish Eating Assessment Tool (T-EAT-10). Dysphagia. 2016;31:644-9.
13. Cano-García L, Redondo-Rodríguez R, Mena-Vázquez N, et al. Severity and impact of digestive impairment perceived by patients with systemic sclerosis: a cross-sectional study. BMJ Open. 2024;14:e083419.
14. Khanna D, Furst DE, Maranian P, et al. Minimally important differences of the UCLA Scleroderma Clinical Trial Consortium Gastrointestinal Tract Instrument. J Rheumatol. 2011;38:1920-4.
15. Snyder DL, Crowell MD, Kahn A, et al. Prevalence of Barrett's esophagus in female patients with scleroderma. Am J Gastroenterol. 2021;116:517-21.
16. Marie I, Dominique S, Levesque H, et al. Esophageal involvement and pulmonary manifestations in systemic sclerosis. Arthritis Rheum. 2001;45:346-54.
17. Christmann RB, Wells AU, Capelozzi VL, Silver RM. Gastroesophageal reflux incites interstitial lung disease in systemic sclerosis: clinical, radiologic, histopathologic, and treatment evidence. Semin Arthritis Rheum. 2010;40:241-9.
18. Savarino E, Bazzica M, Zentilin P, et al. Gastroesophageal reflux and pulmonary fibrosis in scleroderma: a study using pH-impedance monitoring. Am J Respir Crit Care Med. 2009;179:408-13.

DOI: 10.5455/medscience.2024.12.156

19. Eyigor S, Sezgin B, Kuntman BD, et al. Oropharyngeal swallowing functions are impaired in patients with scleroderma. Clin Exp Rheumatol. 2020;38:169-70.

20. Fraticelli P, Pisani AM, Benfaremo D, et al. Videofluorography swallow study in patients with systemic sclerosis: correlation with clinical and radiological features. Clin Exp Rheumatol. 2019;37:108-14.

21. Russo S, Lo Re G, Galia M, et al. Videofluorography swallow study of patients with systemic sclerosis. Radiol Med. 2009;114:948-59.

22. Krause L, Becker MO, Brueckner CS, et al. Nutritional status as marker for disease activity and severity predicting mortality in patients with systemic sclerosis. Ann Rheum Dis. 2010;69:1951-7.

23. Steen VD, Medsger TA. Changes in causes of death in systemic sclerosis, 1972-2002. Ann Rheum Dis. 2007;66:940-4.

24. Domsic RT, Rodriguez-Reyna T, Lucas M, et al. Skin thickness progression rate: a predictor of mortality and early internal organ involvement in diffuse scleroderma. Ann Rheum Dis. 2011;70:104-9.

25. Melissaropoulos K, Iliopoulos G, Sakkas LI, Daoussis D. Pathogenetic aspects of systemic sclerosis: a view through the prism of B cells. Front Immunol. 2022;13:925741.

26. Shand L, Lunt M, Nihtyanova S, et al. Relationship between change in skin score and disease outcome in diffuse cutaneous systemic sclerosis: application of a latent linear trajectory model. Arthritis Rheum. 2007;56:2422-31.

27. Kimmel JN, Carlson DA, Hinchcliff M, et al. The association between systemic sclerosis disease manifestations and esophageal high-resolution manometry parameters. Neurogastroenterol Motil. 2016;28:1157-65.

28. Nakajima K, Kawano M, Kinuya K, et al. The diagnostic value of oesophageal transit scintigraphy for evaluating the severity of oesophageal complications in systemic sclerosis. Nucl Med Commun. 2004;25:375-81.

29. Luquez-Mindiola A, Atuesta AJ, Gómez-Aldana AJ. Gastrointestinal manifestations of systemic sclerosis: an updated review. World J Clin Cases. 2021;9:6201-17.

30. Kuribayashi S, Motegi SI, Hara K, et al. Relationship between esophageal motility abnormalities and skin or lung involvements in patients with systemic sclerosis. J Gastroenterol. 2019;54:950-62.

31. Salaffi F, Di Carlo M, Carotti M, et al. Relationship between interstitial lung disease and oesophageal dilatation on chest high-resolution computed tomography in patients with systemic sclerosis: a cross-sectional study. Radiol Med. 2018;123:655-63.

32. Takekoshi D, Arami S, Sheppard TJ, et al. Computed tomography of the esophagus in scleroderma and lung disease. Tohoku J Exp Med. 2015;237:345-52.

33. Volkmann ER, Tashkin DP, Leng M, et al. Association of symptoms of gastroesophageal reflux, esophageal dilation, and progression of systemic sclerosis-related interstitial lung disease. Arthritis Care Res (Hoboken). 2023;75:1690-7.