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Effect of obesity on patient-reported outcomes in sarcoidosis

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SUMMARY

OBJECTIVES: To assess the impact of high body mass index (BMI) on patient-reported outcomes in sarcoidosis patients and healthy persons.

METHODS: In this case-control study, we investigated symptoms of fatigue and dyspnoea, health status, BMI and spirometric tests in 184 sarcoidosis patients and the same number of sex- and age-matched healthy subjects. Fatigue was assessed using the fatigue scale (FS), dyspnoea was determined by the baseline dyspnoea index (BDI) and health status was measured using the respiratory-specific St George's Respiratory Questionnaire (SGRQ).

RESULTS: There were significantly more subjects with increased BMI (⩾25 kg/m^2) among the sarcoidosis patients than among the healthy volunteers (χ^2 37.675, $P < 0.01$). Sarcoidosis patients also had a greater probability of having a higher BMI ($P < 0.01$, OR 1.18, 95%CI 1.07–1.3). We found significantly lower BDI scores and forced expiratory volume in 1 s/forced vital capacity, as well as higher total SGRQ and total FS scores in sarcoidosis patients than in healthy individuals ($P < 0.01$ for all differences).

CONCLUSION: Sarcoidosis significantly reduces patients' health status, both independently and also due to increased BMI. Reduction in BMI may contribute to improved spirometry results and health status of patients with sarcoidosis.

KEY WORDS: sarcoidosis; health status; patient-reported outcomes; obesity; body mass index; fatigue; dyspnoea

MEASUREMENT of subjective patient-reported outcomes (PRO), such as disease symptoms and health status, has been increasingly adopted in sarcoidosis research in recent years.[1] In this multisystemic granulomatous disorder that most commonly presents in the lungs but may involve any organ, PRO represent aspects of the illness that are different from other objective conventional parameters.[2,3]

Patients with pulmonary sarcoidosis may have symptoms directly affecting the chest, such as cough, dyspnoea, chest pain, chest discomfort and wheeze. Sarcoidosis may also cause constitutional symptoms such as fever, anorexia, weight loss, generalised weakness, fatigue and pain, which are not attributable to the involvement of any specific organ. Fatigue is a major concern of sarcoidosis patients, and influences their health status.[4,5] Health status is a subjective variable that measures the influence of the disease on the physical, psychological and social functioning of patients; it can be used to assess changes in intervention that are associated with perceived health.[6]

The influence of the nutritional status of sarcoidosis patients on PRO has not been studied frequently.[7,8] Moreover, differences in PRO and body weight between sarcoidosis patients and healthy individuals have not been well described. In the current study, we evaluate differences in health status, symptoms of fatigue and dyspnoea, body mass index (BMI) and spirometric pulmonary function tests in sarcoidosis patients and healthy volunteers. In particular, we examine whether a high BMI has an independent effect on health status, fatigue, dyspnoea and spirometric tests in patients with sarcoidosis.

METHODS

This case-control study was conducted at the Clinic for Pulmonology of the Clinical Centre of Serbia, Belgrade, from May 2008 to June 2009. We examined 184 consecutive patients with biopsy-proven pulmonary sarcoidosis. All had non-caseating epithelioid cell granulomas on lung biopsy, with no identified cause. All subjects were aged ⩾18 years, and none had associated illnesses that could influence their health status

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(patients with significant comorbidity, such as respiratory or cardiac disorders, were excluded from the analysis). Extra-pulmonary sites of sarcoidosis were present in 81 patients (42.9%). The majority of the patients (154, 81.5%) were non-smokers. The majority of the patients were treated with prednisone only (55.4%) or with combined prednisone and methotrexate (15.2%), while other patients were given either methotrexate alone (7.1%) or no medication.

Study subjects performed spirometry and completed questionnaires for fatigue, dyspnoea and health status measurement. Nutritional status was assessed by BMI, measured in kg/m^2. The subjects were divided into two groups according to World Health Organization recommendations:[9] those with normal weight (BMI $<$ 25 kg/m^2) and those who were overweight (BMI $\geqslant$ 25 kg/m^2).

Fatigue was assessed using the standardised, validated fatigue scale (FS),[10] which contains 14 questions and distinguishes mental from physical fatigue. A total FS score was also calulated. Each FS score ranges from 1 to 4, with higher scores corresponding to more severe fatigue.

Dyspnoea was measured using the standardised baseline dyspnoea index (BDI),[11] according to which dyspnoea comprises three components: degree of functional impairment, level of activity and level of effort required to develop dyspnoea. Each component is graded on a five-point rating scale from 0 (extreme impairment) to 4 (without impairment); the total score can therefore range from 0 to 12.

Health status was measured by a respiratory-specific measure, the St George's Respiratory Questionnaire (SGRQ),[12] which was originally designed to measure the health status of chronic obstructive pulmonary disease patients.[12] Its validity, reliability and responsiveness have also been proven in other pulmonary diseases. The questionnaire consists of 50 items with 76 responses, and encompasses three health status domains: 1) symptoms, focusing on distress due to respiratory symptoms; 2) activities, measuring decreased mobility or physical activity; and 3) impacts, measuring the psychosocial influence of disease on a patient's everyday life and well-being. All scores are scaled from 0 to 100; higher scores represent poorer health status.

Spirometric measurements included spirometric tests of forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), and the FEV_1/FVC ratio measured using a pneumotachograph (Masterlab, Jaeger, Wurzburg, Germany). The per cent predicted spirometric values were calculated as proposed by Miller et al.[13]

Control group

The control group consisted of 184 sex and age (within $\pm$ 2 years) matched healthy, non-smoking subjects attending periodic systematic health examinations at the Department of Occupational Medicine in three Belgrade health care centres from September 2008 to February 2009. These subjects had no pulmonary disease, nor did they have a previous history of respiratory disease. All filled out the same questionnaires for fatigue, dyspnoea and health status as the sarcoidosis patients, and underwent spirometry.

Statistical analysis

The results are given as frequency, mean $\pm$ standard deviation, and median and interquartile range (IQR). The Mann-Whitney U-test and χ^2 test were used to analyse differences between the sarcoidosis patients and the healthy volunteers. The ratio of the resulting variable (outcome—sarcoidosis) with health status scores, spirometry test values and BMI was examined using binary logistic regression. We tested the significance of differences in health status, fatigue, dyspnoea and spirometric tests among the patient/subject groups using the multivariate analysis of variation (MANOVA) test. The significance level for all analyses was set at $P < 0.05$. Data analysis was performed using the Statistical Package for the Social Sciences, version 18.0 (Statistical Product and Service Solutions, Chicago, IL, USA).

The study was approved by the Ethics Committee of the Clinical Centre of Serbia; consent was obtained from each patient.

RESULTS

The descriptive statistics for BMI, dyspnoea, fatigue and health status scores and spirometry test values in the sarcoidosis patients and the healthy volunteers are shown in Table 1.

Among the 184 sarcoidosis patients, 51 were male and 133 were female. There was no significant difference in age between the sarcoidosis patients and the healthy volunteers (49.4 $\pm$ 10.8 vs. 48.9 $\pm$ 10.3 years). There were significantly more sarcoidosis patients than healthy volunteers with increased BMI $>$ 25 kg/m^2 (144/184 vs. 86/184, χ^2 37.675, $P < 0.01$).

The Kruskal-Wallis test showed no statistically significant difference in BMI values between the treatment groups (χ^2 4.982, $P = 0.173$; Table 2). Univariate analysis showed that only patients on prednisone + methotrexate (and not those on prednisone or methotrexate only) in comparison to those who took no medication had significantly higher physical component scores on the FS (with no changes in total and mental scores), higher total SGRQ scores, lower BDI scores, and lower FEV_1/FVC values; no significant differences in FVC values were observed (Table 3).

Patients with sarcoidosis had significantly higher BMI values than the healthy volunteers (median 28.88 kg/m^2, IQR 6 kg/m^2 vs. 24.46 kg/m^2, IQR 6 kg/m^2; Mann-Whitney U 9026.5, $Z = -7.626$, $P < 0.01$), while the BDI scores were significantly lower

Table 1 Descriptive statistics for BMI, symptoms of dyspnoea and fatigue, health status and spirometry tests in sarcoidosis patients and healthy volunteers

	Percentiles		
Variable/group	25	50	75
BMI, kg/m^2			
Healthy volunteers	21.67	24.46	27.77
Sarcoidosis patients	25.81	28.88	31.57
BDI score			
Healthy volunteers	10.00	12.00	12.00
Sarcoidosis patients	5.00	7.00	9.00
Total fatigue scale score			
Healthy volunteers	2.00	2.00	2.21
Sarcoidosis patients	2.07	2.43	3.00
Total SGRQ score			
Healthy volunteers	0.00	1.85	5.36
Sarcoidosis patients	15.94	33.20	48.00
FEV_1, l			
Healthy volunteers	2.85	3.22	3.83
Sarcoidosis patients	2.31	2.84	3.48
FVC, l			
Healthy volunteers	3.26	3.76	4.57
Sarcoidosis patients	2.98	3.58	4.42
FEV_1/FVC			
Healthy volunteers	83.38	86.66	90.57
Sarcoidosis patients	75.07	79.74	83.92

BMI = body mass index; BDI = baseline dyspnoea index; SGRQ = St George's Respiratory Questionnaire; FEV_1 = forced expiratory volume in 1 s; FVC = forced vital capacity.

in sarcoidosis patients compared to healthy volunteers (median 7, IQR 4 vs. median 12, IQR 2; $U = 3022.0$, $Z = -13.847$, $P < 0.01$). We found significantly lower FEV_1/FVC values ($U = 6490.0$, $Z = -10.132$, $P < 0.01$), higher total SGRQ scores ($U = 2202.5$, $Z = -4.14$, $P < 0.01$) and higher total FS scores ($U = 9189.5$, $Z = -7.508$, $P < 0.01$) in sarcoidosis patients compared to healthy volunteers.

Logistic regression analysis showed that, in comparison with the control group, sarcoidosis patients had a greater risk of a higher BMI (odds ratio [OR] 1.177, 95% confidence interval [CI] 1.069–1.295, $P < 0.01$) and higher total SGRQ scores (OR 1.151, 95%CI 1.087–1.218, $P < 0.01$), but were less likely to have higher FEV_1/FVC values (OR 0.808, 95%CI 0.745–0.876, $P < 0.01$) and BDI scores (OR 0.562, 95%CI 0.414–0.763, $P < 0.01$; Table 4). Total explained variance for this model was 92.2%.

Descriptive statistics for health status, symptoms of fatigue and dyspnoea and spirometry in patients with sarcoidosis and healthy volunteers who were homogenised in terms of BMI (with four groups) are shown in Table 5.

The MANOVA test showed the independent influence of sarcoidosis, both alone and together with the increased BMI values, on spirometric variable FVC% (Fisher's test [F] = 4627.239, $P < 0.01$) and FEV_1/FVC (F = 14166.759, $P < 0.01$). Total explained

Table 2 Differences in BMI between treatment groups

		Percentiles		
Medication	*n* (%)	25	50	75
BMI, kg/m^2				
No medication	41 (22.3)	24.98	29.07	30.12
Prednisone	102 (55.4)	25.31	28.51	31.62
Methotrexate only	13 (7.1)	26.68	29.82	32.03
Prednisone + methotrexate	28 (15.2)	26.41	31.08	35.29

BMI = body mass index.

Table 3 Differences in fatigue, dyspnoea, health status and spirometry variables between treatment groups

Medication	Mean	SD	*n*	F	*P* value
Fatigue scale: physical score					
No medication	2.27	0.66	41	3.211	0.025
Prednisone	2.67	0.72	102		
Methotrexate only	2.54	0.68	13		
Prednisone + methotrexate	2.87	0.60	28		
Fatigue scale: mental score					
No medication	2.25	0.55	41	0.325	0.807
Prednisone	2.35	0.72	102		
Methotrexate only	2.43	0.69	13		
Prednisone + methotrexate	2.43	0.64	28		
Total fatigue scale score					
No medication	2.26	0.57	41	1.619	0.187
Prednisone	2.53	0.66	102		
Methotrexate only	2.49	0.65	13		
Prednisone + methotrexate	2.66	0.57	28		
BDI score					
No medication	8.67	2.41	41	3.368	0.020
Prednisone	6.84	2.81	102		
Methotrexate only	7.15	3.24	13		
Prednisone + methotrexate	6.21	2.83	28		
Total SGRQ score					
No medication	24.13	15.75	41	3.399	0.019
Prednisone	35.22	21.18	102		
Methotrexate only	37.55	23.21	13		
Prednisone + methotrexate	43.12	22.11	28		
FEV_1/FVC					
No medication	80.02	6.12	41	3.482	0.017
Prednisone	79.85	6.59	102		
Methotrexate only	74.39	10.61	13		
Prednisone + methotrexate	76.30	9.27	28		
FVC (%)					
No medication	115.71	13.04	41	1.393	0.247
Prednisone	111.73	17.10	102		
Methotrexate only	105.86	17.00	13		
Prednisone + methotrexate	107.83	16.98	28		

SD = standard deviation; F = Fisher's statistic; BDI = baseline dyspnoea index; SGRQ = St George's Respiratory Questionnaire; FEV_1 = forced volume in 1 s; FVC = forced vital capacity.

Table 4 Regression parameters for the variables health status, dyspnoea, BMI and spirometry (outcome, sarcoidosis patients)

	B	SE	Wald	df	*P* value	OR (95%CI)
BMI, kg/m^2	0.16	0.05	11.09	1	0.001	1.18 (1.07–1.30)
FEV_1/FVC	−0.21	0.04	26.78	1	0.000	0.81 (0.75–0.88)
BDI score	−0.58	0.16	13.64	1	0.000	0.56 (0.41–0.76)
Total SGRQ score	0.14	0.03	23.22	1	0.000	1.151 (1.09–1.22)
Constant	17.54	3.99	19.28	1	0.000	41 246 305.63

BMI = body mass index; SE = standard error; df = degree of freedom; OR = odds ratio; CI = confidence interval; FEV_1 = forced expiratory volume in 1 s; FVC = forced vital capacity; BDI = baseline dyspnoea index; SGRQ = St George's Respiratory Questionnaire.

Table 5 Descriptive statistics for health status, symptoms of fatigue and dyspnoea and spirometry tests in patients with sarcoidosis and healthy volunteers who were homogenised in terms of BMI (cut-off point BMI 25 kg/m^2)

Group	Mean	SD	*n*
FEV_1/FVC			
BMI ⩾25 kg/m^2 in sarcoidosis patients	78.96	7.54	144
BMI ⩾25 kg/m^2 in healthy volunteers	87.52	4.55	88
BMI <25 kg/m^2 in sarcoidosis patients	78.65	7.23	40
BMI <25 kg/m^2 in healthy volunteers	85.60	6.57	96
Total	82.68	7.67	366
FVC%			
BMI ⩾25 kg/m^2 in sarcoidosis patients	110.83	16.22	144
BMI ⩾25 kg/m^2 in healthy volunteers	98.88	11.00	88
BMI <25 kg/m^2 in sarcoidosis patients	112.35	18.61	40
BMI <25 kg/m^2 in healthy volunteers	102.81	14.26	96
Total	106.08	15.79	366
Total fatigue scale score			
BMI ⩾25 kg/m^2 in sarcoidosis patients	2.55	0.63	144
BMI ⩾25 kg/m^2 in healthy volunteers	2.11	0.37	88
BMI <25 kg/m^2 in sarcoidosis patients	2.36	0.66	40
BMI <25 kg/m^2 in healthy volunteers	2.02	0.40	96
Total	2.29	0.57	366
BDI score			
BMI ⩾25 kg/m^2 in sarcoidosis patients	6.85	2.85	144
BMI ⩾25 kg/m^2 in healthy volunteers	11.16	1.22	88
BMI <25 kg/m^2 in sarcoidosis patients	7.73	2.81	40
BMI <25 kg/m^2 in healthy volunteers	11.22	1.06	96
Total	9.11	3.01	366
Total SGRQ score			
BMI ⩾25 kg/m^2 in sarcoidosis patients	35.93	21.80	144
BMI ⩾25 kg/m^2 in healthy volunteers	3.83	5.17	88
BMI <25 kg/m^2 in sarcoidosis patients	27.71	19.05	40
BMI <25 kg/m^2 in healthy volunteers	4.31	5.87	96
Total	19.19	21.74	366

BMI = body mass index; SD = standard deviation; FEV_1 = forced expiratory volume in 1 s; FVC = forced vital capacity; BDI = baseline dyspnoea index; SGRQ = St George's Respiratory Questionnaire.

variance for FVC% was 98.1% (partial $R^2 = 0.981$) and FEV_1/FVC was 99.4% (partial $R^2 = 0.994$). Sarcoidosis and increased BMI (both separately and jointly) significantly influenced total FS scores ($F = 745.020$, $P < 0.01$), BDI scores ($F = 1694.897$, $P < 0.01$) and total SGRQ scores ($F = 226.747$, $P < 0.01$). Partial R^2 for the total FS score was 0.951, and for BDI it was 0.949, while the lowest value (0.715) was observed for the total SGRQ score.

DISCUSSION

The present study showed that patients with sarcoidosis are more easily tired and more likely to be dyspnoeic, have poorer health status, greater body weight and lower pulmonary function than healthy individuals of the same sex and similar age. We found no significant difference in the FVC% between those with normal vs. elevated BMI in either the sarcoidosis or the control population. The degree of obesity in patients with elevated BMI may not have been large enough to influence the FVC%. The effect of BMI on fatigue and dyspnoea may thus not have been simply due to the restrictive effect of obesity.

Current outcome measures used in clinical trials of sarcoidosis are focused on objective measurements of organ function, and generally fail to account for the overall functioning of the patient or the impact of treatment on aspects of the patient's life.[14,15] A study by Cox et al. showed that physicians experienced in the treatment of sarcoidosis showed poor correlation with patients concerning the presence of sarcoidosis-related symptoms.[16] It was suggested that this discordance stemmed from physicians' excessive reliance on objective tests. In addition, treatment for sarcoidosis may also affect PRO. In particular, corticosteroid therapy is often associated with weight gain.

It is likely that constitutional symptoms of sarcoidosis, such as fatigue and being overweight, contributed to functional limitation and consequently had an important effect on health status. The items in the respiratory-specific SGRQ questionnaire relate to physical activities and the impact of disease on the patient's level of functioning. It is possible that being overweight with sarcoidosis negatively impacted these items.

With increase in body weight, PRO deteriorates; this is especially the case for symptoms of fatigue and dyspnoea and health status in sarcoidosis patients.[17] Patients with normal body weight expressed mild fatigue and dyspnoea, while those who were overweight had worse scores for these subjective outcomes. As the patient's perception of dyspnoea depends on the physical activities and effort he/she requires to feel breathless, those patients who are overweight may be more dyspnoeic as they are more functionally limited.

It has been hypothesised that fatigue due to sarcoidosis is caused by inflammatory mediators released from granulomatous inflammation.[18] In addition, it was previously demonstrated that BMI in sarcoidosis patients, together with waist circumference and triglycerides/high-density lipoprotein cholesterol ratio, represents a good predictor of insulin resistance syndrome, i.e., metabolic syndrome. Metabolic syndrome can be a cause of fatigue in sarcoidosis patients with normal pulmonary function as assessed by the spirometric parameter FEV_1. Patients with chronic sarcoidosis and metabolic syndrome have poorer metabolisation of glucose, particularly in the periphery (in skeletal muscles), due to lowered insulin sensitivity. This results in increased perception of fatigue in patients with normal FEV_1 values. The patient's perception of both symptoms and health status could thus be the consequence of ongoing metabolic events in the organism.

The topic of fatigue in sarcoidosis has been covered in recent publications.[19–21] Authors have studied the relationship between serum cytokine levels, skeletal muscle function, low-level exercise and fatigue in sarcoidosis patients. The present paper, however, is the first to assess the association of obesity with health status, fatigue, dyspnoea and lung function.

Nutritional status, and patient's functioning in everyday life, which is the component of their health status, are directly related. Riazi et al. recently demonstrated a significant impact of obesity on all aspects of functioning and health-related quality of life (HRQL) in a UK population of obese children and adolescents aged 8–18 years. The difference noticed between the HRQL scores of these study subjects and healthy controls was statistically significant ($P < 0.005$).[22]

HRQL is poor in obese subjects, and it is a relevant outcome in intervention studies.[23] Mannucci et al. showed that in obese patients seeking to lose weight in medical facilities in Italy, HRQL scores were significantly lower in women than in men.[23] Greater impairment of HRQL was observed in relation to increasing BMI.

Previous studies have demonstrated that pulmonary function testing cannot act as a surrogate for these other variables, and that it cannot be used to assess the overall health of sarcoidosis patients.[24]

There are several similarities between our results and those reported by Baydur et al.: their sarcoidosis population sample had the same average age as the current study (49 years), The values of the FEV_1/FVC variable were similar in both sarcoidosis patients and the healthy control group, and nutritional status was better among patients than controls.[24] The authors found that dyspnoea, as the most common presentation in early to moderately advanced sarcoidosis, more closely correlates with maximal respiratory pressure than with lung volume and diffusing capacity of the lung for carbon monoxide.

Study patients who used both prednisone and methotrexate had significantly greater physical (but not mental) fatigue and dyspnoea scores and better overall health status than those who did not use any medication. Similar deterioration in fatigue and dyspnoea were found by Baydur et al. in patients receiving treatment, despite the absence of differences in lung function.[21]

Our study limitations include the exclusion of smokers from the control group, as such an approach would have an impact on the comparison between the two groups with regard to the PRO assessed and spirometry testing. Another limitation is that the patients studied were on different treatment regimens. While there was no difference in BMI for sarcoidosis patients currently on prednisone or other treatment vs. no treatment, this may not reflect prior treatment. Prolonged treatment with corticosteroids has been associated with significant weight gain.[25] However, as current treatment did not influence BMI, the effect of sarcoidosis on BMI may be due to other factors, such as restrictive activity and fatigue associated with the disease. In addition, there was no difference in the fatigue reported by sarcoidosis patients currently receiving prednisone vs. those on no treatment, in line with reports from other studies.[26,27] Finally, although we excluded subjects with severe overt comorbidity from this study, our results may also have been affected by unmeasured comorbidities.

We conclude that for an accurate assessment of spirometric changes associated with changes in symptoms and health status of patients with sarcoidosis, it is necessary to homogenise the patient groups in terms of BMI, as sarcoidosis disease, both independently and associated with increased BMI, significantly impairs patients' symptoms and health status. Reduction in BMI may potentially contribute to improvements in the pulmonary function and health status of patients with sarcoidosis. Further research is required to better understand the relationship between the complex relationship between subjective PRO in sarcoidosis and conventional objective measures. A longitudinal case-control study assessing PROs and BMI both at baseline and during follow-up is required.

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References

1 Gvozdenovic B S, Mihailovic-Vucinic V, Videnovic J, Zugic V, Ilic-Dudvarski A, Filipovic S. Quality of life and health status in sarcoidosis patients. Chapter 6. In: Hoffmann E C, ed. Health-related quality of life. New York, NY, USA: Nova Science Publishers, 2009: pp 119–132.

2 Hunninghake G W, Costabel U, Ando M, et al. ATS/ERS/WASOG statement on sarcoidosis. American Thoracic Society/European Respiratory Society/World Association of Sarcoidosis and other Granulomatous Disorders. Sarcoidosis Vasc Diffuse Lung Dis 1999; 16: 149–173.

3 Bauer M P, Brouwer P A, Smit V T, Tamsma J T. The challenges of extrapulmonary presentations of sarcoidosis: a case report and review of diagnostic strategies. Eur J Intern Med 2007; 18: 152–154.

4 Sharma O P. Fatigue and sarcoidosis. Eur Respir J 1999; 13: 713–714.

5 Michielsen H J, Peros-Golubicic T, Drent M, de Vries J. Relationship between symptoms and quality of life in a sarcoidosis population. Respiration 2007; 74: 401–405.

6 Bradley C. Importance of differentiating health status from quality of life. Lancet 2001; 357: 7–8.

7 Belojević G, Marić-Zivković J. Sarcoidosis and obesity. Med Pregl 2005; 58 (Suppl 1): 44–45.

8 Vesely D L. Hypothalamic sarcoidosis: a new cause of morbid obesity. South Med J 1989; 82: 758–761.

9 World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation on obesity. WHO Technical Report Series 894. Geneva, Switzerland: WHO, 2000.

10 Chalder T, Berelowitz G, Pawlikowska T, et al. Development of a fatigue scale. J Psychosom Res 1993; 37: 147–153.

11 Mahler D A, Weinberg D H, Wells C K, Feinstein A R. The measurement of dyspnoea: contents, interobserver agreement, and physiologic correlates of two new clinical indexes. Chest 1984; 85: 751–758.

12 Jones P W, Quirk F H, Baveystock C M, Littlehohns P. A self-complete measure of health status for chronic airflow limitation.

The St George's Respiratory Questionnaire. Am Rev Respir Dis 1992; 145: 1321–1327.
13 Miller M R, Hankinson J, Brusasco V, et al. Standardisation of spirometry. Eur Respir J 2005; 26: 319–338.
14 Victorson D E, Cella D, Judson M A. Quality of life evaluation in sarcoidosis: current status and future directions. Curr Opin Pulm Med 2008; 14: 470–477.
15 Wirnsberger R M, Drent M, Hekelaar N, et al. Relationship between respiratory muscle function and quality of life in sarcoidosis. Eur Respir J 1997; 10: 1450–1455.
16 Cox C E, Donohue J F, Brown C D, Kataria Y P, Judson M A. Health-related quality of life of persons with sarcoidosis. Chest 2004; 125: 997–1004.
17 Gvozdenovic B. Assessment of clinical outcomes influence on health status in sarcoidosis patients. PhD thesis. Belgrade, Serbia: Belgrade University, 2010.
18 Drent M, Wirnsberger R M, de Vries J, van Dieijen-Visser M P, Wouters E F, Schols A M. Association of fatigue with an acute phase response in sarcoidosis. Eur Respir J 1999; 13: 718–722.
19 Boots A W, Drent M, Swennen E L, Moonen H J, Bast A, Haenen G R. Antioxidant status associated with inflammation in sarcoidosis: a potential role for antioxidants. Respir Med 2009; 103: 364–732.
20 Spruit M A, Thomeer M J, Gosselink R, et al. Skeletal muscle weakness in patients with sarcoidosis and its relationship with exercise intolerance and reduced health status. Thorax 2005; 60: 32–38.
21 Baydur A, Alavy B, Nawathe A, Liu S, Louie S, Sharma O P. Fatigue and plasma cytokine concentrations at rest and during exercise in patients with sarcoidosis. Clin Respir J 2011; 5: 156–164.
22 Riazi A, Shakoor S, Dundas I, Eiser C, McKenzie S A. Health-related quality of life in a clinical sample of obese children and adolescents. Health Qual Life Outcomes 2010; 8: 134.
23 Mannucci E, Petroni M L, Villanova N, et al. Clinical and psychological correlates of health-related quality of life in obese patients. Health Qual Life Outcomes 2010; 8: 90.
24 Baydur A, Alsalek M, Louie S G, Sharma O P. Respiratory muscle strength, lung function, and dyspnoea in patients with sarcoidosis. Chest 2001; 120: 102–108.
25 Baughman R P, Winget D B, Lower E E. Methotrexate is steroid sparing in acute sarcoidosis: results of a double blind, randomized trial. Sarcoidosis Vasc Diffuse Lung Dis 2000; 17: 60–66.
26 de Kleijn W P, Elfferich M D, de Vries J, et al. Fatigue in sarcoidosis: American versus Dutch patients. Sarcoidosis Vasc Diffuse Lung Dis 2009; 26: 92–97.
27 de Vries J, Rothkrantz-Kos S, Dieijen-Visser M P, Drent M. The relationship between fatigue and clinical parameters in pulmonary sarcoidosis. Sarcoidosis Vasc Diffuse Lung Dis 2004; 21: 127–136.

RÉSUMÉ

OBJECTIFS : Evaluer l'impact d'un index de masse corporelle (BMI) élevé sur les résultats signalés par des patients atteints de sarcoïdose et chez les sujets sains.

MÉTHODES : Dans cette étude cas-contrôle, nous avons investigué les symptômes de fatigue et de dyspnée, l'état de santé, le BMI et les tests spirométriques chez 184 patients atteints de sarcoïdose et chez le même nombre de sujets sains appariés pour le sexe et l'âge. On a évalué la fatigue par l'echelle fatigue (FS), déterminé la dyspnée par l'index de base de dyspnee (BDI), et mesuré l'état de santé par le Questionnaire Respiratoire Spécifique St George (SGRQ).

RÉSULTATS : Par comparaison avec les volontaires sains, on a noté chez les patients atteints de sarcoïdose un nombre plus élevé de sujets dont le BMI était augmenté ($\geqslant$25 kg/m^2 ; χ^2 37.675, $P < 0{,}01$). Les patients atteints de sarcoïdose encouraient également un risque plus élevé d'un BMI augmenté davantage ($P < 0{,}01$; OR 1,177 ; IC95% 1,069–1,295). Par comparaison avec les individus sains, nous avons trouvé chez les patients atteints de sarcoïdose des scores de BDI ainsi que des valeurs du rapport volume expiratoire maximum second/capacité ventilatoire forcée significativement plus faibles ainsi que des scores globaux plus élevés du SGRQ et des scores globaux plus élevés de FS ($P < 0{,}01$ pour toutes les différences).

CONCLUSION : L'état de santé des patients est significativement diminué à la fois de manière indépendante et en association avec une augmentation du BMI. Une réduction du BMI pourrait contribuer à l'amélioration des données spirométriques et de l'état de santé des patients atteints de sarcoïdose.

RESUMEN

OBJETIVOS: Evaluar la repercusión de un alto índice de masa corporal (BMI) en las variables subjetivas notificadas por los pacientes en los casos de sarcoidosis y en las personas sanas.

MÉTODOS: En el presente estudio de casos y testigos se investigaron los síntomas de fatiga y disnea, el estado de salud, el BMI y las pruebas espirométricas en 184 pacientes con sarcoidosis y el mismo número de testigos sanos, emparejados con respecto al sexo y la edad. La fatiga se evaluó mediante la escala de fatiga (FS), la disnea se determinó mediante el índice de disnea basal (BDI), y el estado de salud se cuantificó mediante el cuestionario respiratorio específico de Saint George (SGRQ).

RESULTADOS: En los pacientes con sarcoidosis se observó un número significativamente mayor de personas con un alto BMI ($\geqslant$25 kg/m$^{2)}$ en comparación con los testigos sanos (χ^2 37,675; $P < 0{,}01$). Este grupo exhibió también una probabilidad más alta de tener un mayor BMI ($P < 0{,}01$; OR 1,177; IC95% 1,069–1,295). Se observó además que los pacientes con sarcoidosis presentaban puntuaciones más bajas en la BDI y el cociente flujo espiratorio forzado medio en un segundo/capacidad vital forzada que los testigos sanos y asimismo puntuaciones globales más altas en el SGRQ y en la FS ($P <$ 0,01 para todas las diferencias).

CONCLUSIÓN: La sarcoidosis altera significativamente el estado de salud de los pacientes de manera independiente y también en asociación con el alto BMI. La disminución del BMI podría contribuir a mejorar los resultados de las pruebas funcionales respiratorias y el estado de salud de estos pacientes.