EVALUATION OF QUALITY OF LIFE IN PATIENTS WITH METABOLIC SYNDROME AND RISK OF SLEEP APNEA USING SF-36 SHORT FORM

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Rezumat

Asistența medicală modernă subliniază importanța evaluării calității vieții pacienților cu sindrom metabolic și risc de apnee în somn, folosind instrumente validate precum SF-36 Short Form. Studiile evidențiază o prevalență ridicată a sindromului metabolic în România, cu o frecvență de 45% la femei și 44% la bărbați, și asocierea sa frecventă cu apneea în somn datorită factorilor de risc comuni.

Rezultatele cercetărilor indică o conexiune strânsă între hipertensiunea arterială, dislipidemie și rezistența la insulină, toate acestea fiind factori centrali ai sindromului metabolic. În plus, sindromul de apnee în somn contribuie la agravarea complicațiilor cardiometabolice prin episoade recurente de hipopnee și apnee, care determină fragmentarea somnului și hipoxemie intermitentă.

Aceste disfuncții activează cascade hemodinamice, autonome și inflamatorii, accentuând riscurile cardiometabolice și reducând calitatea vieții. Obiectivul studiului de față este să investigheze corelațiile dintre parametrii metabolici și calitatea vieții, oferind perspective valoroase asupra mecanismelor care interconectează sindromul metabolic și apneea în somn.

Cuvinte cheie: *sindrom metabolic, apnee în somn, calitatea vieții, parametri metabolici, inflamație.*

Abstract

Modern healthcare emphasizes the importance of assessing the quality of life in patients with metabolic syndrome and risk of sleep apnea using validated tools such as the SF-36 Short Form. Studies reveal a high prevalence of metabolic syndrome in Romania, with rates of 45% in women and 44% in men, and its frequent association with sleep apnea due to shared risk factors.

Research findings indicate a strong connection between hypertension, dyslipidemia, and insulin resistance, all of which are central components of metabolic syndrome. Furthermore,

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sleep apnea exacerbates cardiometabolic complications through recurrent episodes of hypopnea and apnea, leading to sleep fragmentation and intermittent hypoxemia.
These dysfunctions trigger cascades of hemodynamic, autonomic, and inflammatory responses, increasing cardiometabolic risks and impairing quality of life. The objective of this study is to investigate the correlations between metabolic parameters and quality of life, offering valuable insights into the mechanisms linking metabolic syndrome and sleep apnea.
Keywords: *metabolic syndrome, sleep apnea, quality of life, metabolic parameters, inflammation.*

Introduction

Metabolic syndrome is frequently associated with an increased risk of developing cardiovascular diseases, which can decompensate and manifest through a complete spectrum of clinical signs and symptoms, ranging from stable angina to myocardial infarction with persistent ST-segment elevation. Additionally, this syndrome is linked to the onset of type 2 diabetes, cerebrovascular diseases such as transient ischemic attack and ischemic stroke, as well as conditions like alcoholic and non-alcoholic fatty liver disease, polycystic ovary syndrome, and sleep apnea syndrome [1].

Studies indicate a connection between essential hypertension, dyslipidemia characterized by elevated triglycerides and decreased HDL cholesterol, and increased insulin resistance, with this association being referred to as syndrome X[2]. Statistics show a prevalence of metabolic syndrome in Romania of 45% in women and 44% in men [3-7]. Considering that risk factors are common for both metabolic syndrome and sleep apnea syndrome, the coexistence of these two conditions in the same patient is frequently encountered.

Sleep apnea syndrome (SAS) is defined as a complex condition characterized by recurrent episodes of partial (hypopnea) or complete (apnea) obstruction of the upper airways[8]. These episodes result in frequent micro-awakenings, which fragment sleep structure and cause intermittent hypoxemia.

These processes trigger cascades of hemodynamic, autonomic, and inflammatory responses, with significant implications for

cardiometabolic health[9-10]. The SF-36 Short Form is a widely validated tool for assessing quality of life, covering eight domains that encompass both physical and mental health. The aim of this project is to assess the quality of life in patients with metabolic syndrome at risk of sleep apnea and to identify associations between metabolic parameters and QoL[11,12].

Study Objectives

The general objective of the study is to evaluate the score derived from the SF-36 Short Form Questionnaire in correlation with hemodynamic parameters in patients with metabolic syndrome and the risk of obstructive sleep apnea, focusing on monitoring clinical and biological parameters to identify effective personalized management strategies.

The first specific objective is to analyze hemodynamic parameters such as blood pressure, oxygen saturation, and heart rate to compare changes between study groups (control, diet therapy, diet therapy combined with probiotics) and assess the impact of interventions on cardiovascular and respiratory functions. Another objective is to investigate the relationship between metabolic syndrome and obstructive sleep apnea by correlating metabolic parameters (BMI, visceral fat, HOMA index) with hemodynamic markers to understand the connection between metabolic risk and hemodynamic complications.

The study aims to assess the impact of therapeutic interventions on hemodynamic markers, analyzing the effects of diet therapy and probiotic supplementation on blood pressure, oxygen saturation, and cardiovascular stability to identify the most effective interventions.

Another objective is to investigate the role of neurotransmitters GABA and glutamate in regulating hemodynamic function, highlighting their contribution to the interaction between metabolism, inflammation, and cardiovascular function. The study also analyzes the evolution of patients' quality of life in relation to hemodynamic and metabolic changes, using the SF-36 questionnaire to evaluate the impact of interventions on physical, emotional, and social functioning.

By comparing results between intervention groups, the study seeks to identify differences in hemodynamic evolution between patients who followed diet therapy alone and those who benefited from diet therapy combined with probiotics, contributing to a better understanding of the factors involved in the management of metabolic syndrome and the risk of obstructive sleep apnea.

Study Design

The study has an observational and interventional design, including an initial cross-sectional assessment of quality of life and a longitudinal component for analyzing the effects of interventions. Participants are divided into three groups: control, diet therapy, and diet therapy combined with probiotics, totaling 192 patients.

The study population consists of 192 patients with metabolic syndrome and the risk of sleep apnea, selected based on diagnostic criteria. Demographic distribution shows that 43.8% come from urban areas and 56.2% from rural areas, with 79.2% being male. The mean age is 38.96 ± 14.63 years, indicating an increased metabolic risk among the adult population.

Data is collected through clinical assessments and the use of the SF-36 questionnaire to measure quality of life. Biological parameters analyzed include BMI, visceral fat, HOMA index, cholesterol, and triglycerides, while the

risk of sleep apnea is assessed using the STOP-BANG questionnaire. Assessments are performed at baseline (T0) and after 6 months (T1). Statistical analysis includes demographic evaluation, comparison of SF-36 scores between groups using ANOVA, correlation analysis between biological parameters and quality of life through Spearman tests, and evaluation of the impact of interventions using paired t-tests and mixed models for repeated measures.

Inclusion Criteria

The inclusion and exclusion criteria for patients in the study are presented in Table 1. These strict criteria were implemented to minimize potential sources of variation and to allow for an accurate analysis of the impact of the interventions on the study population.

Methodology

The study followed the hemodynamic evolution of patients with metabolic syndrome and risk of obstructive sleep apnea, dividing the participants into three groups (control, diet therapy, diet therapy with probiotics) and monitoring them for 6 months. Diet therapy included a personalized dietary plan, reducing saturated fats, refined carbohydrates and sodium, and promoting proteins, fibers and unsaturated fats. The probiotic group received standardized supplements without additives.

Clinical and biological parameters, such as BMI, fat mass, HOMA index, cholesterol and oxygen saturation, were assessed at baseline and after 6 months. Quality of life was measured with the SF-36, and the risk of apnea with the STOP-BANG questionnaire.

Results

Dietary and probiotic interventions and QoL scores

Table 2 presents the changes in SF-36 scores, used to assess quality of life before and after the intervention, in the control, diet therapy and diet therapy with probiotics groups.

Initial SF-36 scores did not show significant differences between groups ($p = 0.553$), indicating a similar quality of life at the beginning of the study, with comparable means of scores between groups. After the intervention, SF-36 scores increased significantly, with modest improvements in the control group (68.78 ± 7.45) and greater in the diet therapy group (72.38 ± 5.85), highlighting the benefits of the personalized diet.

The diet therapy combined with probiotics group recorded the greatest progress (76.25 ± 5.81), demonstrating the synergistic effect of probiotics and diet on quality of life.

The results highlight that dietary interventions, especially when combined with probiotics, can significantly improve the quality of life of patients with metabolic

Inclusion Criteria	Exclusion Criteria
Age between 18 and 65 years old.	Patients with severe chronic diseases (renal or hepatic failure, active neoplasms, or chronic gastrointestinal disorders).
Diagnosis of metabolic syndrome and obstructive sleep apnea.	Patients taking medication that affects neurotransmitter levels (antiepileptics or antipsychotics);
Body mass index (BMI) of 25 kg/m² or higher.	pregnant or breastfeeding women.

Table 1. *Inclusion and Exclusion Criteria*

Parameters	Group of patients						X2	p
	Control		Dietotherapy		Dietotherapy and probiotic			
	Mean	SD	Mean	SD	Mean	SD		
SF 36 initial	66,25	7,10	67,88	6,42	67,55	7,51	1,344	0,553
SF 36 final	68,78	7,45	72,38	5,85	76,25	5,81	36,893	0,001

Table 2. *Changes in SF-36 Short Form Scores between Study Groups before and after Intervention. SD=standard deviation; Mean=average of the studied values.*

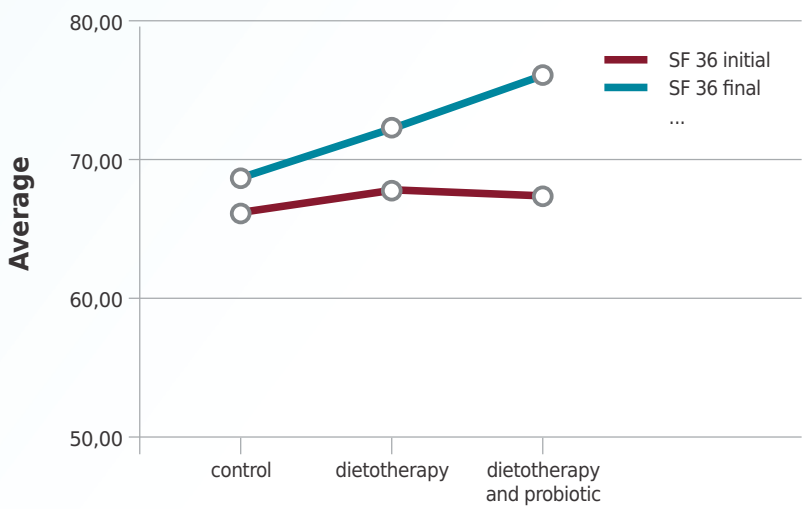

Figure 1. *Evolution of initial and final SF-36 scores between study groups (Control, Diet Therapy and Diet Therapy combined with Probiotics)*
6.2 Metabolic parameters (high BMI, visceral fat, increased HOMA) associated with SF-36 scores.

syndrome and risk of obstructive sleep apnea.

Figure 1 shows the evolution of the mean SF-36 scores before and after the intervention for the three groups, indicating the changes in quality of life.

In the control group, the SF-36 score increased slightly, showing that, without specific interventions, quality of life remained almost constant, with minor changes due to non-specific factors.

The diet therapy group recorded a greater increase in the SF-36 score, demonstrating that the dietary interventions had a positive impact on health and quality of life. The diet therapy group combined with probiotics had the greatest increase in the SF-36 score, highlighting the effectiveness of this intervention in improving quality of life. The p-value of 0.000 confirms a high statistical significance, showing that the studied interventions significantly improved the quality of life of the participants.

The results in Table 3 show the correlations between SF-36 scores and metabolic, hemodynamic and biochemical parameters, providing information about the factors that influence the quality of life of patients with metabolic syndrome and risk of apnea.

The initial SF-36 scores did not have significant correlations with the analyzed parameters, such as BMI, visceral fat or the neurotransmitters GABA and glutamate, indicating a reduced influence of them on the initial quality of life.

The final SF-36 scores revealed a significant negative correlation between the reduction of HOMA and quality of life ($r = -0.155$, $p = 0.032$), highlighting the role of glycemic control in improving well-being.

Reduction in respiratory distress had a weak and insignificant positive correlation with final SF-36 scores, and the neurotransmitters GABA and glutamate did not show relevant correlations.

Reduction in insulin resistance appears to be a key factor in improving quality of life, suggesting the need for targeted interventions for glycemic control and respiratory distress.

Baseline SF-36 scores were similar between participants with and without apnea risk (67.60 and 67.26), suggesting that apnea risk did not influence perceived quality of life at baseline.

At the end of the study, SF-36 scores increased significantly for both groups (73.33 and 73.30), indicating that the interventions improved quality of life, regardless of baseline apnea risk. Participants without final apnea risk had higher SF-36 scores (73.74) compared to those with final apnea risk (69.65), showing that reducing apnea risk is associated with better quality of life.

The interventions improved quality of life overall, but remaining apnea risk at baseline was associated with lower SF-36 scores,

Correlations			SF 36 initial	SF 36 final
Spearman's rho	BMI difference	rho	0,003	-0,009
		Sig.	0,971	0,903
	Visceral fat difference	rho	-0,036	-0,013
		Sig.	0,621	0,855
	HOMA difference	rho	-0,139	-0,155*
		Sig.	0,055	0,032
	Fat mass difference	rho	-0,048	-0,098
		Sig.	0,511	0,177
	Respiratory difference	rho	0,005	0,118
		Sig.	0,950	0,102
	Apnea difference	rho	0,000	-0,077
		Sig.	1,000	0,286
	GABA	rho	-0,113	-0,060
		Sig.	0,117	0,410
	Glutamate	rho	-0,067	0,078
		Sig.	0,356	0,283
		N	192	192

Table 3. *Spearman correlations between SF-36 scores and metabolic, hemodynamic, and biochemical parameters. N=number of patients; Sig. = statistical significance; 6.3 Patients at risk of sleep apnea and SF-36 scores*

Parameters			SF 36 initial	SF 36 final
Initial apnea risk	absent	Mean	67,60	73,33
		SD	7,29	7,44
	present	Mean	67,26	73,30
		SD	6,72	5,93
Final apnea risk	absent	Mean	67,64	73,74
		SD	7,03	6,76
	present	Mean	65,70	69,65
		SD	6,70	5,37

Table 4. *SF-36 scores by apnea risk at baseline and end of study. SD=standard deviation.*

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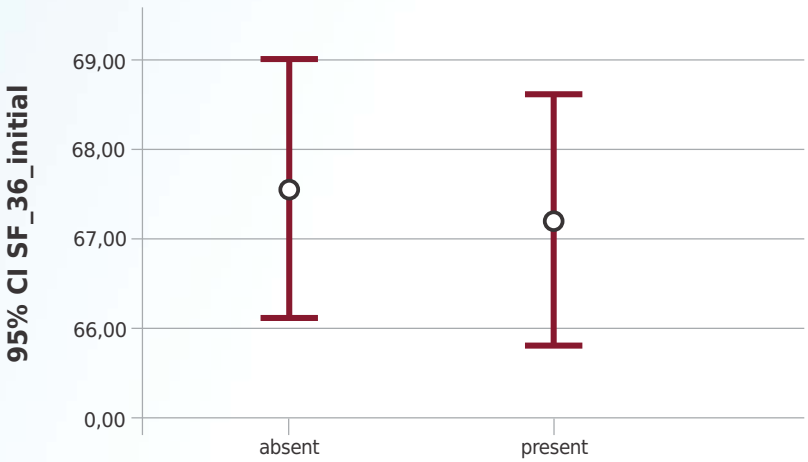

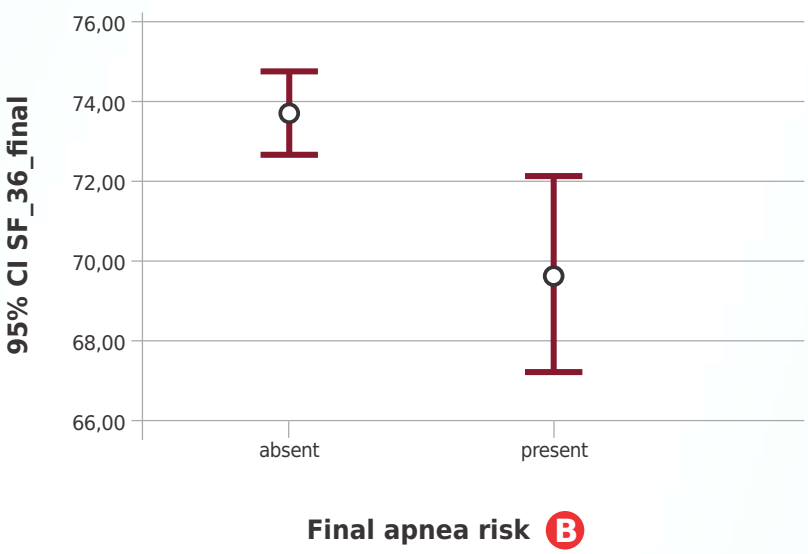

Figure 2. *Graphical representation of SF-36 scores according to the presence of apnea risk at baseline (A) and end of the study (B)*

highlighting the importance of managing this risk.

Figure 2 highlights the differences in SF-36 scores between patients with absent and present risk of sleep apnea, both at baseline and at the end of the intervention.

At the beginning of the study, the SF-36 scores of patients without risk of apnea were slightly higher than those with present risk, but the differences were not statistically significant.

At the end of the study, patients without risk of apnea had higher SF-36 scores than those with persistent risk, and the increased variability in the at-risk group reflects different responses to the interventions.

The reduction in the risk of sleep apnea is associated with significant improvements in quality of life, highlighting the effectiveness of integrated interventions in improving overall well-being.

Discussion

The study shows a significant improvement in quality of life in patients who followed diet therapy and diet therapy combined with probiotics, compared to the control group, thus supporting the positive effects of these interventions on the health and quality of life of patients with metabolic syndrome and obstructive sleep apnea.

Dietary interventions demonstrated in this study a significant improvement in SF-36 scores, confirming the results of previous studies.

For example, a study by Santos et al. (2024) showed that a low-calorie diet, rich in fiber and unsaturated fats, significantly improved physical functioning and general health status among patients with metabolic syndrome[13]. Similarly, a systematic review by Sears et al. (2015) highlighted that dietary changes can reduce inflammatory markers and improve overall health perception[14,15]. Our study confirms these results, highlighting that diet therapy plays a central role in improving quality of life, mainly by reducing inflammation and cardiovascular risk factors.

The addition of probiotics to dietary interventions produced the most significant improvements in SF-36 scores in our study, which is consistent with the findings of Evrensel and Ceylan (2016)[16], who demonstrated that probiotics can positively influence mental and physical health by modulating the microbiota-gut-brain axis[17,18]. Probiotics have been associated with reducing systemic inflammation and improving metabolic function, thus contributing to an improved perception of quality of life. These effects are also supported by the study of Arora et al. (2013)[19], who highlighted that probiotics can reduce oxidative stress and improve overall functioning in patients with metabolic disorders[20,21].

Our study showed a positive association between reduced risk of obstructive sleep apnea and improved quality of life. This result is in line with the findings of Romero-Corral et al. (2010)[22], who highlighted that weight loss and reduction of visceral fat, outcomes commonly associated with dietary interventions, can improve the severity of obstructive sleep apnea[23,24,25]. Furthermore, the study of Vgontzas et al. (2005) showed that reduced inflammation and improved metabolic markers, including HOMA and visceral fat, contribute to better sleep quality and reduced apnea symptoms, which is reflected in higher quality of life scores[26].

Another important aspect observed in our study is the negative correlation between HOMA index and SF-36 scores[27], indicating that reducing insulin resistance is a key factor in improving health perception. These findings are supported by the study of Iftikhar et al.

(2015)[28], which showed that interventions that reduce insulin resistance have a significant impact on the quality of life of patients with metabolic syndrome. Also, reductions in visceral fat and fat mass, indicators of metabolic risk[29], were correlated with improvements in physical functioning and general health, similar to the findings of Shuster et al. (2012)[30].

While the results of our study are consistent with most existing research, the differences observed between the diet therapy alone and diet therapy combined with probiotics emphasize the need to better understand the mechanisms of interaction between probiotics and metabolism. Studies by Kho and Lal (2018) highlighted that variability in gut microbiota composition between individuals can significantly influence responses to probiotics, which partially explains the variability observed in our study[30].

Institutional Review Board Statement: The study was carried out in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board. The study was carried out in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board (or Ethics Committee) of the University of Oradea (protocol code Nr. CEFMF/1. 31.10.24) and date of approval).

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