

**A COMPARATIVE ANALYSIS OF AGE, ACTIVE SMOKING, AND OBESITY IN PATIENTS
WITH RHEUMATOID ARTHRITIS AND OSTEOARTHRITIS**

Marija Milošević¹, Suzana Radovanović¹, Ivana Aleksić Milenković²

¹Primary Health Care Centre Niš, Niš, Serbia

²Institute for Treatment and Rehabilitation "Niška Banja", Clinic of Rheumatology, Niška Banja, Serbia

Contact: Marija Milošević

61/2 Nikole Pašića Str., 18000 Niš, Serbia

E-mail: milmary80@gmail.com

Rheumatoid arthritis (RA) and osteoarthritis (OA) are chronic joint diseases with distinct etiopathogenetic mechanisms. Age, smoking, and obesity may be associated with their development, clinical course, and treatment outcomes. This study aimed to compare age and the prevalence of current smoking and obesity, defined as a body mass index (BMI) ≥ 30 kg/m², between patients with RA and OA. This observational, analytical cross-sectional study included 60 patients who attended follow-up examinations at the Primary Health Care Centre Niš between June 2024 and September 2025 and whose diagnoses had been established at the Clinic of Rheumatology, Institute for Treatment and Rehabilitation "Niška Banja." Participants were divided into the RA group (n=30) and the OA group (n=30). Age, BMI, and current smoking status were recorded. Continuous variables were presented as the mean $\pm$ standard deviation and categorical variables as numbers and percentages. Student's or Welch's *t*-test and Fisher's exact test were

used for group comparisons. Statistical significance was set at $p < 0.05$. Patients with RA were significantly older than those with OA (67.2 ± 10.4 vs. 53.1 ± 13.4 years; $p < 0.01$). Obesity was recorded in 8 (26.7%) patients with RA and 12 (40.0%) with OA, without a statistically significant difference ($p = 0.41$). Current smoking was reported in 11 (36.6%) patients with RA and 9 (30.0%) with OA, also without a significant difference ($p = 0.75$). Age was the only characteristic that differed significantly between the groups. Larger studies with age- and sex-matched groups are needed.

Keywords: rheumatoid arthritis; osteoarthritis; age; smoking; obesity

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**UPOREDNA ANALIZA STAROSTI, AKTIVNOG PUŠENJA I GOJAZNOSTI KOD BOLESNIKA
SA REUMATOIDNIM ARTRITISOM I OSTEOARTRITISOM**

Marija Milošević¹, Suzana Radovanović¹, Ivana Aleksić Milenković²

¹Dom zdravlja Niš, Niš, Srbija

²Instituta za lečenje i rehabilitaciju „Niška Banja“, Klinika za reumatologiju, Niška Banja, Srbija

Kontakt: Marija Milošević

Nikole Pašića 61/2; 18000 Niš

E-mail: milmary80@gmail.com

Reumatoidni artritis (RA) i osteoartritis (OA) predstavljaju hronična oboljenja zglobova različite etiopatogeneze. Starost, pušenje i gojaznost mogu biti povezani sa njihovim nastankom, kliničkim tokom i ishodom lečenja. Uporediti starost i zastupljenost aktivnog pušenja i gojaznosti, definisane kao indeks telesne mase (BMI) $\geq 30 \text{ kg/m}^2$, kod bolesnika sa RA i OA. Opservacionom analitičkom studijom preseka obuhvaćeno je 60 bolesnika koji su se javljali na kontrolne preglede u Dom zdravlja Niš od juna 2024. do septembra 2025. godine, a kod kojih je dijagnoza postavljena na Klinici za reumatologiju Instituta za lečenje i rehabilitaciju „Niška Banja“. Ispitanici su podeljeni u dve grupe: RA grupu (n=30) i OA grupu (n=30). Evidentirani su starost, BMI i aktuelni pušački status. Kontinuirane varijable prikazane su kao srednja vrednost $\pm$ standardna devijacija, a kategorijske kao broj i procenat. Za poređenje grupa korišćeni su Studentov, odnosno Welchov t-test i Fisherov egzaktni test. Statistička značajnost određena je na nivou $p < 0,05$. Bolesnici sa RA bili su značajno stariji od bolesnika sa OA ($67,2 \pm 10,4$ prema $53,1 \pm 13,4$ godine; $p < 0,01$). Gojaznost je zabeležena kod 8 (26,7%) bolesnika sa RA i 12 (40,0%) bolesnika sa OA, bez statistički značajne razlike ($p = 0,41$). Aktivno pušenje bilo je prisutno kod 11 (36,6%) bolesnika

sa RA i 9 (30%) bolesnika sa OA, takođe bez značajne razlike ($p=0,75$). Starost je bila jedina ispitivana karakteristika koja je značajno razlikovala grupe. Gojaznost je bila numerički češća kod OA, a aktivno pušenje kod RA, ali bez statističke značajnosti. Potrebna su istraživanja na većem, starosno i polno usklađenom uzorku.

Ključne reči: reumatoidni artritis; osteoartritis; starost; pušenje; gojaznost.

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Introduction

Rheumatoid arthritis (RA) and osteoarthritis (OA) are two major chronic joint diseases that cause pain, limited mobility, reduced work capacity, and impaired quality of life. Although they may have similar clinical manifestations, they differ substantially in their etiology, pathogenesis, and clinical course. RA is a chronic systemic autoimmune disease characterized by persistent synovial inflammation, progressive cartilage and bone damage, and extra-articular manifestations. In contrast, OA is a heterogeneous whole-joint disease involving cartilage degeneration, subchondral bone remodeling, osteophyte formation, synovial inflammation, and changes in periarticular structures (1–3).

The global burden of these diseases continues to increase. According to data from the Global Burden of Disease study, the number of people with RA is expected to reach approximately 31.7 million by 2050, representing an increase of around 80% compared with 2020 (1). It is estimated that approximately 595 million people, or 7.6% of the world's population, were living with some form of OA in 2020, with the number of affected individuals expected to continue rising (2). These trends are associated with population aging, the increasing prevalence of obesity, and exposure to environmental and lifestyle-related factors.

Age is an important non-modifiable factor associated with both diseases. RA can develop at any age, but its incidence increases with age, and disease onset is increasingly observed among middle-aged and older individuals (1,3). Age is particularly important in OA, as cellular senescence, reduced regenerative capacity of chondrocytes, oxidative stress, the accumulation of extracellular matrix damage, and prolonged mechanical loading contribute to the deterioration of joint structures (4,5). Nevertheless, OA is not an inevitable consequence of aging but rather the result of interactions among biological, mechanical, metabolic, and genetic factors.

Cigarette smoking is one of the most firmly established modifiable risk factors for RA, particularly for the seropositive form of the disease. This association is especially pronounced in genetically predisposed individuals, including carriers of certain HLA-DRB1 alleles. Tobacco smoke contributes to oxidative stress, inflammation of the respiratory mucosa, post-translational protein modifications, and the formation of anti-citrullinated protein antibodies, thereby potentially initiating and sustaining the autoimmune response (3,6). Current smoking may be associated with greater RA disease activity, more extensive joint damage, and a poorer therapeutic response. Smoking, increased body weight, and other modifiable factors may collectively be associated with a substantial proportion of incident RA cases (6).

The association between smoking and OA has not been fully elucidated. Some studies have indicated an increased risk, others an apparently protective effect, whereas still others have found no significant association. These discrepancies may be attributable to the effects of sex, age, BMI, smoking intensity and duration, OA site, and differences in diagnostic criteria (5,7). More recent experimental and genetic epidemiological studies suggest that smoking may disrupt osteoimmune homeostasis, increase oxidative stress and inflammation, and adversely affect bone and cartilage metabolism (8).

Obesity, most commonly defined as a BMI ≥ 30 kg/m², is an important modifiable factor associated with both diseases. In RA, adipose tissue may contribute to chronic inflammation through adipokines and proinflammatory cytokines. Obesity is associated with greater disease activity, more pronounced functional limitations, and a lower likelihood of achieving remission, with potential effects of sex, serological status, and adipose tissue distribution (3,6).

The association between obesity and OA is particularly pronounced in weight-bearing joints, such as the knee and hip. Increased body weight results in greater biomechanical loading, while adipokines, metabolic disturbances, and low-grade systemic inflammation contribute to cartilage degeneration and changes in the subchondral bone (4,5,7). The association between obesity and hand OA indicates that its effects are not exclusively mechanical but also involve systemic metabolic and inflammatory mechanisms.

Given the distinct pathogenesis of RA and OA, a comparative assessment of age, current smoking, and obesity may contribute to a better understanding of patient characteristics and facilitate the planning of preventive measures, lifestyle modifications, and individualized therapeutic approaches.

The aim of this study was to compare age and the prevalence of current smoking and obesity, defined as a BMI ≥ 30 kg/m², between patients with rheumatoid arthritis and those with osteoarthritis.

Materials and Methods

This research was conducted as an observational, analytical cross-sectional study in accordance with the STROBE recommendations for reporting observational studies (9). The study included 60 patients who attended follow-up examinations at the Primary Health Care Centre Niš between June 2024 and September 2025 and whose diagnoses had been established at the Clinic of Rheumatology, Institute for Treatment and Rehabilitation "Niška Banja." The participants were

divided into two equal groups: 30 patients with rheumatoid arthritis (RA group) and 30 patients with osteoarthritis (OA group). Data were collected through patient examinations and a retrospective review of medical records.

The study included adult patients of both sexes with a confirmed diagnosis of RA or OA and available data on age, body weight, height, and smoking status. The diagnosis was established by a rheumatologist based on medical history, clinical examination, laboratory tests, and radiographic findings.

RA was diagnosed according to the 2010 ACR/EULAR classification criteria, which include the number and distribution of affected joints, serological markers, acute-phase reactants, and symptom duration. Classification as RA required the presence of synovitis in at least one joint, the absence of an alternative disease that could better explain the synovitis, and a score of at least 6 out of a possible 10 points (10).

The diagnosis of OA was based on characteristic clinical features and radiographic changes. Clinical indicators included pain associated with movement and weight-bearing, brief morning stiffness, crepitus, restricted range of motion, and bony enlargement of the joint. Radiographic indicators included joint-space narrowing, osteophytes, subchondral sclerosis, and subchondral cysts. Knee OA was classified according to the American College of Rheumatology criteria (11).

Patients were excluded if they had concomitant RA and OA for which the primary diagnosis could not be clearly determined, other inflammatory rheumatic diseases, infectious arthritis, crystal arthropathies, incomplete medical records, or a lack of reliable data required to determine BMI and smoking status.

For each participant, the following variables were recorded: diagnosis, age, body weight, height, BMI, presence of obesity, and current smoking status. Age was expressed in completed years on the date of study enrollment.

Assessment of Obesity

Body weight was measured using a standardized medical scale with a precision of 0.1 kg, while height was measured in the standing position without shoes using a stadiometer. When data were obtained from medical records, measurements performed at enrollment or at the nearest available examination were used.

BMI was calculated using the following formula:

$$\text{BMI} = \frac{\text{body weight (kg)}}{\text{height}^2 (\text{m}^2)}$$

In accordance with the internationally accepted classification, obesity was defined as a BMI ≥ 30 kg/m² (12). Participants were classified as patients with obesity (BMI ≥ 30 kg/m²) or without obesity (BMI < 30 kg/m²).

Assessment of Smoking Status

Smoking data were obtained using a standardized questionnaire and by reviewing medical records. A participant who smoked cigarettes daily or occasionally at the time of enrollment was classified as a current smoker. Former smokers and individuals who had never smoked were classified as non-current smokers. Smoking status was analyzed as a dichotomous variable: current smoker or non-current smoker.

The primary outcomes were the difference in mean age and differences in the prevalence of obesity and current smoking between the RA and OA groups. Owing to the cross-sectional design, the results reflect the characteristics of the study sample and do not permit causal inferences regarding disease development.

Statistical Analysis

Statistical analysis was performed using SPSS, version 18. Continuous variables were presented as the mean $\pm$ standard deviation, whereas categorical variables were expressed as the number and percentage of participants, n (%).

The normality of the distribution of continuous variables was assessed using the Shapiro–Wilk test, and the homogeneity of variances was evaluated using Levene's test. Mean age was compared between the groups using Student's *t*-test for independent samples or Welch's *t*-test when variances were unequal. The Mann–Whitney *U* test was planned for data that did not meet the assumptions of parametric testing. Differences in the prevalence of obesity and current smoking were assessed using Fisher's exact test.

All tests were two-sided, and a *p*-value < 0.05 was considered statistically significant. The results of categorical comparisons could additionally be presented as odds ratios (ORs) with 95% confidence intervals.

Results

The study included a total of 60 patients, with 30 patients in each of the rheumatoid arthritis and osteoarthritis groups. The results of the comparisons of age, obesity, and current smoking are presented in Table 1.

Patients with RA were, on average, older than those with OA (67.2 ± 10.4 vs. 53.1 ± 13.4 years). The difference in mean age between the groups was statistically significant ($p < 0.01$).

Obesity, defined as a BMI ≥ 30 kg/m², was identified in 8 (26.7%) patients with RA and 12 (40.0%) patients with OA. Although obesity was numerically more prevalent in the OA group, the difference was not statistically significant ($p = 0.41$).

Current smoking was reported in 11 (36.6%) patients with RA and 9 (30.0%) patients with OA. Current smokers were numerically more prevalent in the RA group; however, this difference was also not statistically significant ($p = 0.75$).

Table 1. Comparison of age, obesity, and current smoking between patients with rheumatoid arthritis (RA) and osteoarthritis (OA)

Characteristic	RA (n = 30)	OA (n = 30)	p-value
Age, years	67.2 ± 10.4	53.1 ± 13.4	< 0.01
Obesity (BMI ≥ 30 kg/m ²), n (%)	8 (26.7%)	12 (40.0%)	≈ 0.41
Current smoking, n (%)	7 (23.3%)	5 (16.7%)	≈ 0.75

Data are presented as the mean $\pm$ standard deviation or as the number and percentage of patients, n (%). A p-value < 0.05 was considered statistically significant.

Discussion

This study compared age and the prevalence of current smoking and obesity, defined as a BMI ≥ 30 kg/m², in patients with rheumatoid arthritis and osteoarthritis. Patients with RA were significantly older, obesity was numerically more prevalent in the OA group, whereas current smoking was slightly more prevalent in the RA group. However, the differences in the prevalence of obesity and current smoking were not statistically significant.

The mean age of patients with RA was 67.2 ± 10.4 years, compared with 53.1 ± 13.4 years in patients with OA. The difference of 14.1 years was statistically significant, but it cannot be interpreted as evidence that age is more strongly associated with RA than with OA. Age is an important factor in both diseases, particularly in OA, the incidence and prevalence of which progressively increase with advancing age (2,4,5).

In OA, aging contributes to chondrocyte senescence, the accumulation of molecular and structural damage, impaired extracellular matrix turnover, and changes in the subchondral bone. Nevertheless, OA is not an inevitable consequence of aging but rather the result of interactions among age, obesity, previous injuries, and biomechanical, genetic, and metabolic factors (4,5,14). Recent evidence also indicates an increasing prevalence of early-onset OA, particularly among individuals with obesity, previous injuries, and prolonged occupational or sports-related joint loading (14). Therefore, the mean age of 53.1 years in the OA group was not unexpected.

RA can develop at any age, but its incidence increases with age and often peaks during the sixth and seventh decades of life (1,3). The mean age of the RA group is consistent with a population of patients with established disease. However, age at study enrollment rather than age at disease onset was analyzed, which should be considered when interpreting the results.

The age difference between the groups may also have affected the comparisons of smoking and obesity. Age is associated with changes in smoking habits, smoking cessation, body composition, physical activity, and comorbidities. Therefore, future analyses should match the groups for age and sex or adjust the results using multivariable analysis.

Obesity was identified in 8 patients with RA (26.7%) and 12 patients with OA (40.0%). Although its prevalence was 13.3 percentage points higher in the OA group, the difference was not statistically significant ($p=0.41$). This finding demonstrates a numerical difference within the study sample but does not support the conclusion that obesity is more prevalent in the OA population than in the RA population.

The higher prevalence of obesity in the OA group is biologically plausible. Increased body weight places greater mechanical stress on the knees and hips, alters movement biomechanics, and contributes to cartilage and subchondral bone damage. At the same time, adipose tissue produces adipokines and proinflammatory mediators, including leptin, resistin, interleukin 6, and tumor necrosis factor alpha, which may contribute to synovial inflammation and cartilage catabolism (4,7,14).

The association between obesity and hand OA demonstrates that its effects are not exclusively mechanical but also involve systemic metabolic and inflammatory mechanisms. Recent studies suggest that the combination of increased fat mass and reduced muscle mass may be more relevant than BMI alone to symptom severity and functional impairment in OA (14). The global burden of OA attributable to elevated BMI continues to increase, particularly for knee OA (18).

Obesity is also important in RA. Adipose tissue may sustain systemic inflammation, while increased body weight contributes to pain, reduced mobility, and poorer functional status. Patients with RA and obesity frequently exhibit higher estimated disease activity, a lower likelihood of achieving remission, and a poorer response to certain therapeutic modalities (3,6). However, BMI does not distinguish adipose tissue from muscle tissue, which is particularly important in long-standing RA, where muscle loss may coexist with a relative increase in adipose tissue. Future studies should therefore include waist circumference and direct assessments of body composition.

Current smoking was recorded in 11 patients with RA (36.6%) and 9 patients with OA (30.0%). The difference of 6.6 percentage points was not statistically significant ($p=0.75$). Thus, current smoking was only numerically more prevalent in the RA group. The limited number of smokers and the small sample size may have reduced the ability to detect a difference between the groups.

Smoking is one of the most firmly established modifiable risk factors for RA, particularly for ACPA-positive disease. Tobacco smoke promotes inflammation of the respiratory mucosa, oxidative stress, protein citrullination, and loss of immune tolerance. These effects are especially pronounced in genetically predisposed carriers of HLA-DRB1 shared epitope alleles (3,8). Recent evidence suggests that passive exposure to tobacco smoke may also be associated with RA among individuals who have never actively smoked (15).

Smoking may also adversely affect the course of established RA. A systematic review and meta-analysis showed that smokers were more likely to have an inadequate response to methotrexate than non-smokers (16). Information on smoking status is therefore important for risk assessment, treatment planning, and counseling patients on smoking cessation.

The absence of a significant difference in current smoking may be explained by the fact that former smokers were analyzed together with individuals who had never smoked. Cumulative tobacco exposure is important in RA, and the increased risk may persist after smoking cessation. Furthermore, older patients with RA may have been more likely to quit smoking because of comorbidities or medical advice. The number of cigarettes smoked per day, smoking duration, pack-years, passive exposure, and RA serological status were not analyzed, which may have resulted in an underestimation of the association between smoking and RA.

The association between smoking and OA remains insufficiently understood. Observational studies have yielded neutral, harmful, or apparently protective associations. The purported protective effect may be attributable to lower BMI among smokers, selection bias, and

other confounding factors (5,7). Recent Mendelian randomization analyses suggest that a genetic predisposition to smoking initiation and long-term smoking may be associated with an increased risk of knee and hip OA (17). Nevertheless, these findings should be confirmed in prospective studies using more precise assessments of tobacco exposure.

Overall, the study groups differed significantly only in age. The higher prevalence of obesity among patients with OA and current smoking among those with RA represents numerical patterns within this sample rather than confirmed differences or evidence of causal relationships.

Strengths and Limitations of the Study

The strengths of this study include the direct comparison of two clinically relevant groups, equal group sizes, a clearly defined obesity threshold of BMI ≥ 30 kg/m², and the separate analysis of current smoking status.

The principal limitations are the small sample size and cross-sectional design, which preclude assessment of temporal relationships and causal associations. The groups were not matched for age and sex. Smoking was analyzed only according to its current presence or absence, without data on former smoking, smoking intensity and duration, or pack-years. Obesity was assessed solely using BMI, without evaluating central obesity or body composition.

Disease duration, RA serological status, OA site and radiographic stage, pharmacotherapy, physical activity, previous joint injuries, and comorbidities were also not analyzed. Future studies should include larger samples, groups matched for age and sex, more detailed assessments of tobacco exposure and body composition, and multivariable analyses.

Patients with RA in this study were significantly older than those with OA. Obesity was numerically more prevalent among patients with OA, whereas current smoking was numerically more prevalent among those with RA; however, these differences were not statistically significant. These results support the importance of weight management and smoking cessation in both groups but do not confirm differences in their prevalence between the RA and OA populations.

Conclusion

Patients with rheumatoid arthritis were significantly older than those with osteoarthritis. Although obesity was more prevalent among patients with OA and current smoking among those with RA, the observed differences were not statistically significant. Therefore, age was the only characteristic examined that differed significantly between the groups.

These findings should be interpreted in the context of the small sample size and cross-sectional study design. Studies involving larger samples and groups matched for age and sex are needed to provide a more reliable assessment of the significance of smoking and obesity.

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