**Original Studies**

**Originalni naučni radovi**

University of Novi Sad, Faculty of Medicine Novi Sad

Special Hospital for Rheumatic Diseases, Novi Sad

University of Niš, Faculty of Medicine Niš

Institute for Prevention, Treatment and Rehabilitation of Rheumatic and Cardiovascular Diseases “Niška Banja”, Niš

Health Center “Novi Sad”, Novi Sad

Institute of Child and Youth Health Care of Vojvodina, Novi Sad

---

**RISK FACTORS FOR HAND OSTEOARTHRITIS**

**FAKTORI RIZIKA ZA NASTANAK OSTEOARTROZE ŠAKE**

Jelena ZVEKIĆ SVORCAN, Bojana STAMENKOVIĆ, Ivana MINAKOVIĆ, Rastislava KRASNIK, Tanja JANKOVIĆ and Aleksandra MIKOV

---

**Summary**

**Introduction.** Hand osteoarthritis is a joint degenerative disease characterized by hand deformities affecting the hand strength and function, leading to greater disability and increased healthcare utilization. The objective of this study was to estimate the impact of different risk factors on the incidence of hand osteoarthritis. **Material and Methods.** The study was a prospective cross-sectional study conducted at the Special Hospital for Rheumatic Diseases Novi Sad, Serbia, during a one year period (2017 - 2018). It included 100 postmenopausal women aged 60 to 70 years presenting with pain in the hands ≥ 3 according to the visual analogue scale. All respondents were divided into two groups, according to radiographic findings graded using the Kellgren-Lawrence scale. Risk factors responsible for the development of hand osteoarthritis were examined and the research procedure included medical history data, physical examination of the hand joints, anthropometric measurements, and laboratory tests. Statistical processing and analysis was performed using Statistical Package for the Social Sciences ver. 25. **Results.** Statistically significant differences were found between the two groups in relation to positive family history of degenerative changes in the hand joints (p = 0.000), as well as in relation to metabolic syndrome (p = 0.001). **Conclusion.** A positive family history of degenerative changes of the hands and presence of metabolic syndrome are significant risk factors for the development of hand osteoarthritis. **Key words:** Osteoarthritis; Hand Joints; Wrist; Metacarpus; Risk Factors; Menopause; Postmenopause; Female

---

**Sažetak**

**Uvod.** Osteoartroza šake predstavlja degenerativnu bolest zglobova za koju su karakteristični deformiteti šake koji utiču na snagu i funkciju šake, a koji vode većoj invalidnosti, te povećanju učestalosti korišćenja zdravstvene zaštite. Cilj rada je procena uticaja različitih faktora rizika na pojavu osteoartroze šake. **Materijal i metode.** Istraživanje je sprovedeno u specijalnoj bolnici za reumatske bolesti u Novom Sadu, Srbija, u periodu od jedne godine (2017–2018). Studija je obuhvatala 100 žena u menopauzi starosti od 60 do 70 godina, koje su imale bolove u šakama ≥ 3 označeno prema vizuelnoj analognoj skali. Ispitanice su bile podeljene u dve grupe u odnosu na radiografski nalaz na šakama prema Kelgren-Lawrence skali (Kellgren-Lawrence). Ispitivani su faktori rizika koji bi mogli biti odgovorni za nastanak osteoartroze šake, a istraživački postupak je uključivao dobijanje anamnestičkih podataka, fizikalni pregled zglobova šake, antropometrijska merenja i laboratorijske analize. Statistička obrada i analiza urađena je u statističkom paketu SPSS ver. 25. **Rezultati.** Statistički značajna razlika je primetljiva između dve grupe u odnosu na postojanje pozitivne porođišne anamneze o strukturnim promenama na zglobovima šaka (p = 0,000) kao i u odnosu na postojanje metaboličkog sindroma (p = 0,001). **Zaključak.** Pozitivna porođišna anamneza o strukturnim promenama na šakama i prisustvo metaboličkog sindroma predstavljaju značajan faktor rizika za nastanak osteoartroze šake. **Ključne reči:** osteoartritis; zglobovi ruke; šaka; metakarpus; faktori rizika; menopauza; postmenopauza; žensko

---

**Corresponding Author:** Doc. dr Jelena Zvekić Svorcan, Univerzitet u Novom Sadu, Medicinski fakultet, Specijalna bolnica za reumatske bolesti, 21000 Novi Sad, Futoška 68, E-mail: jelena.zvekic-svorcan@mf.uns.ac.rs
of joint loading, and factors at the personal level such as – age, sex, obesity and genetic factors [3]. Risk factors for OA include biomechanical and systemic factors and they are not fully understood, which means harmful health behaviour may possibly contribute to OA affecting joint tissues [4]. One of the most frequent locations affected by OA is the hand [5]. Human hand is the evolutionary culmination in the development of all living beings [6]. It is composed of numerous bones and muscles and its complex structure allows heterogeneous functions and daily activities [7]. Hand OA is characterized by deformities which affect hand strength and function, leading to greater disability and increased health care utilization [5]. Hand OA is associated with hand pain, stiffness, loss of mobility which all lead to a reduction in quality of life [8]. A longitudinal study conducted in several European countries within the European project on OA that included individuals aged 65 - 85 years, indicated that the overall prevalence of clinical OA at any site was 30.4% and 16.3% had hand OA [9]. The proportion of the population who will develop symptomatic hand OA is defined as a lifetime risk. This risk was estimated from models using generalized estimating equations and had included the development of symptomatic hand OA in at least one hand by the age of 85 years. The lifetime risk of symptomatic hand OA was 39.8% and it was particularly high among women. It was estimated that 1 in 2 women will develop symptomatic hand OA by the age 85 years, compared to 1 in 4 men [5]. Considering there is no disease-modifying drug for OA, it is important to reduce the risk for developing hand OA by decreasing modifiable risk factors [2]. The OA is related to an extremely high economic burden and indirect costs for OA are also high which is caused by both work-related losses and home care cost [10]. Regarding all the above mentioned, our study aimed to estimate the impact of different risk factors on the incidence of hand OA.

Material and Methods

A prospective cross-sectional study was conducted at the Special Hospital for Rheumatic Diseases Novi Sad, Serbia, during a one year period (2017 – 2018). The Research was approved by the Ethics Committee of the Special Hospital for Rheumatic Diseases Novi Sad and the Ethics Committee of the Faculty of Medicine Novi Sad, Serbia. First, all respondents signed informed consent forms to take part in the study. The research included 100 postmenopausal women who met the inclusion criteria: age from 60 to 70 years, hand pain ≥ 3 according to the visual analogue scale [11]. All respondents were divided into two groups, according to radiographic findings of hands which were in line with Kellgren–Lawrence scale [12, 13]. The study group included respondents with radiographic progression on their hand joints classified as II – IV grade, while the control group included respondents with 0 and I grade according to the Kellgren–Lawrence scale. The exclusion criteria were as follows: inflammatory rheumatic disease, tenosynovitis of the hand and carpal tunnel, previous hand surgery, use of corticosteroid therapy and physical therapy 3 months before enrollment into the study.

Research procedure: obtaining medical history data, physical examination of the hand joints, anthropometric measurements – body height (cm), body weight (kg), calculation of the body mass index (BMI) (kg/m²), waist circumference measurement with a tape measure (cm), blood pressure measurement with a sphygmomanometer (mmHg), laboratory tests – glycemia (mmol/l), cholesterol (mmol/l), high-density lipoprotein cholesterol (mmol/l) and triglycerides (mmol/l) – which were measured in the morning, on an empty stomach. The components of the metabolic syndrome (MetS) were determined according to the clinical definition of the MetS by National Cholesterol Education Program – Adult Treatment Panel III (NCEP-ATPIII) [14]. All respondents were examined for potential risk factors that may be responsible for hand OA: occupation (work that requires repeated finger movements, lifting and carrying heavy loads - strong grips, work that requires precise grip and work in administration), BMI, cigarette smoking, alcohol consumption, physical activity, time of onset of menopause (entering menopause before and after the age of 45), duration of menopause, fractures or minor trauma, family history of fractures, family history of structural changes in the hands and diagnosed MetS.

Numerical variables were analyzed by arithmetic mean and standard deviation, while categorical variables were analyzed by frequencies and percentages. Chi-square test and Student’s-test were used for testing differences. The univariate logistic regression was performed first to distinguish the predictors of hand OA. The hand OA was used as a dependent variable coded as a dummy variable. Categorical independent variables have undergone some categorization, to better define reference categories. Before conducting the logistic regression, multicollinearity of the dependent variables was examined. Multicollinearity was investigated to provide stable and precise regression coefficients. Tolerance level and variance inflation factor (VIF) were used as indicators of multicollinearity. The univariate binary and multivariate models were used to determine the risk factors for hand OA. The Odds ratio was used in the interpretation of the results combined with the 95% confidence interval. The multivariate model was conducted by the forward method. Statistical processing and analysis were performed in the statistical package SPSS ver. 25.

Results

The research included 100 subjects, postmenopausal women, 60 in the study and 40 in the control group. A comparison was made between the 2 groups in relation to potential risk factors for hand

**Abbreviations**

OA – osteoarthritis  
BMI – body mass index  
MetS – metabolic syndrome
OA. No statistically significant difference was found between the study and control group (p > 0.05) in relation to the previous occupation, including lifting and carrying heavy loads and strong grips, work that requires repeated finger movements, work that requires precise grip and work in administration. Most

| Occupation, n (%) | Study group | Control group | p       | All respondents |
|------------------|-------------|---------------|---------|-----------------|
|                  | Eksperimentalna grupa (n = 60) | Kontrolna grupa (n = 40) |         | Svi ispitanici (n = 100) |
| Lifting and carrying heavy loads, strong grips | 17 (28.3%) | 14 (35.0%) |         | 31 (31.0%) |
| Work that requires repeated finger movements | 11 (18.3%) | 3 (7.5%) | 0.061a | 14 (14.0%) |
| Work that requires precise grip | 11 (18.3%) | 2 (5.0%) |         | 13 (13.0%) |
| Work in administration | 21 (35.1%) | 21 (52.5%) |         | 42 (42.0%) |
| BMI, n (%) |         |              |         |                |
| Underweight | 1 (1.7%) | 1 (2.5%) |         | 2 (2.0%) |
| Normal weight | 7 (11.7%) | 10 (25.0%) | 0.203a | 17 (17.0%) |
| Overweight and obesity | 52 (86.7%) | 29 (72.5%) |         | 81 (81.0%) |

**Table 1. Demographic characteristics of patients**

| Smoking status, n (%) | Study group | Control group | p       | All respondents |
|-----------------------|-------------|---------------|---------|-----------------|
| Smoker | 9 (15.00%) | 5 (12.50%) | 0.327a | 14 (14.00%) |
| Ex-smoker | 12 (20.00%) | 4 (10.00%) |         | 16 (16.00%) |
| Non smoker | 39 (65.00%) | 31 (77.50%) |         | 70 (70.00%) |

| Alcohol consumption, n (%) | Study group | Control group | p       | All respondents |
|---------------------------|-------------|---------------|---------|-----------------|
| Yes | 0 (0%) | 1 (2.50%) | 0.218a | 1 (1.00%) |
| No/Ne | 60 (100%) | 39 (97.50%) |         | 99 (99.00%) |

| Physical activity, n (%) | Study group | Control group | p       | All respondents |
|-------------------------|-------------|---------------|---------|-----------------|
| Low | 32 (53.30%) | 24 (60.00%) | 0.511a | 56 (56.00%) |
| Moderate | 28 (46.70%) | 16 (40.00%) |         | 44 (44.00%) |

| Time of menopause onset, n (%) | Study group | Control group | p       | All respondents |
|------------------------------|-------------|---------------|---------|-----------------|
| Before the age of 45 | 10 (16.7%) | 10 (25.0%) | 0.307b | 20 (20.0%) |
| After the age of 45 | 50 (83.3%) | 30 (75.0%) |         | 80 (80.0%) |

| Duration of menopause, M±SD | Study group | Control group | p       | All respondents |
|-----------------------------|-------------|---------------|---------|-----------------|
| 16.2±5.62 | 17.9±5.74 | 0.147b | 16.9±5.70 |

| Fractures to minor trauma, n (%) | Study group | Control group | p       | All respondents |
|----------------------------------|-------------|---------------|---------|-----------------|
| Yes/Ne | 12 (20.0%) | 10 (25.0%) | 0.383a | 22 (22.0%) |

| Family history of fractures among relatives, n (%) | Study group | Control group | p       | All respondents |
|---------------------------------------------------|-------------|---------------|---------|-----------------|
| Yes/Ne | 17 (28.3%) | 9 (22.5%) | 0.515a | 26 (26.0%) |

| Family history of structural changes in the hand joints, n (%) | Study group | Control group | p       | All respondents |
|---------------------------------------------------------------|-------------|---------------|---------|-----------------|
| Yes/Ne | 43 (71.7%) | 31 (77.5%) |         | 74 (74.0%) |

| Metabolic syndrome, n (%) | Study group | Control group | p       | All respondents |
|----------------------------|-------------|---------------|---------|-----------------|
| Yes/Ne | 49 (81.7%) | 20 (50.0%) | 0.001a | 69 (69.0%) |

Legend: *χ2 – Chi-square test; Student’s t-test; p – statistical significance

Legenda: *χ2 – Hi-kvadrat test; Studentov t-test; p – statistička značajnost, ITM - indeks telesne mase
of the examinees from both groups were overweight (81%), but no statistically significant difference was observed between the groups comparing the BMI. Most of the respondents were non-smokers (70%), while the percentage of smokers and ex-smokers was similar (14% vs. 16%) and no statistically significant difference was found between groups in relation to smoking status. Almost all participants reported that they did not consume alcohol (99%) and there was no statistically significant difference between the groups.

Likewise, there was no statistically significant difference between two groups with regard to the existence of fractures to minor trauma or positive family history of fractures among relatives. Statistically significant differences were observed between two groups in relation to positive family history of structural changes in the hand joints (p = 0.001) (Table 1). First, a binary logistic regression was performed, and then, in order to explain the existence of hand OA, the contribution of each individual variable was evaluated. As statistically significant predictors for hand OA, using univariate regression analysis, the following were distinguished: family history of structural changes in the hand joints (Wald = 31.00, p = 0.000) and MetS (Wald = 10.56, p = 0.001). Individuals with a positive family history of structural changes in the hand had a 17 times higher chance of developing OA of the hand than women with a negative family history (OR: 17.81; 95% CI (6.46 – 49.10)). This variable alone explained 32% of the variance of the dependent variable. Individuals with MetS had a 4 times higher chance of

| Occupation - Work that requires repeated finger movements | Wald | p     | OR       |
|----------------------------------------------------------|------|-------|----------|
| Zanimanje - Rad koji zahteva ponavljane pokrete prstiju  | 6.698| 0.082 |          |
| Lifting and carrying heavy loads, strong grips (1)       | 2.203| 0.138 | 0.331    |
| Dizanje i nošenje teškog tereta, snažni hvatovi (1)     |      |       | 0.077    |
| Work that requires precise grip (2)                      |      |       | 1.425    |
| Rad koji zahteva precizni hvat (2)                       | 0.162| 0.687 | 1.500    |
| Work in administration (3)/Rad u administraciji (3)     | 3.250| 0.071 | 0.273    |

| BMI - Normal weight/ITM - Normalna uhranjenost | Wald | p     | OR       |
|------------------------------------------------|------|-------|----------|
| Underweight (1)/Pothranjenost (1)              | 0.057| 0.812 | 1.429    |
| Overweight and obesity (2)/Prekomerna uhranjenost i gojaznost (2) | 2.983| 0.084 | 2.562    |

| Smoking status/PUŠAČKI status                   | 1.761| 0.184 | 1.855    |
| Physical activity/Fizička aktivnost             | 0.432| 0.511 | 0.762    |
| Time of menopause onset (years)                 | 1.030| 0.310 | 0.600    |
| Vreme ulaska u menopauzu (godine)               |      |       | 0.224    |

| Duration of menopause/Trajanje menopauze         | 2.089| 0.148 | 0.948    |
| Fractures to minor trauma/Prelomi i male traume  | 0.348| 0.555 | 0.750    |
| Family history of fractures among relatives      | 0.423| 0.515 | 1.362    |
| Porodična anamneza o prelomima kod bliskih srodnika |      |       | 0.537    |

| Family history of structural changes in the hand joints | 31.004| 0.001 | 17.818   |
| Porodična anamneza o strukturnim promenama na zglobovima šaka |      |       | 6.465    |

| Metabolic syndrome/Metabolički sindrom            | 10.561| 0.001 | 4.45     |

Legend: The variable alcohol consumption was excluded from the regression model, due to the small number of respondents by category (N = 1)

Legenda: Varijabla konzumiranja alkohola isključena je iz regresionog modela, zbog malog broja ispitanika po kategorijama (N=1). ITM - indeks telesne mase

p – statistical significance; OR – odds ratio; OR – količnik šansi

Zvekić Svorcan J, et al. Risk Factors for Hand Osteoarthritis
There are different definitions of OA, so that may cause different results. Considering the known connection between obesity and pain, it is more likely that there is an association between obesity and clinical OA definitions, than with radiographic definitions [2]. There have been different studies which have shown opposite results about the effect of smoking on hand OA. While some studies reported a protective role of smoking on OA, others reported an association between smoking and increased risk for cartilage loss [21]. We found no evidence for the association between cigarette smoking and hand OA, comparing smokers, ex-smokers and nonsmokers. Haugen et al. reported less severe hand OA in smokers as compared to never smokers in cross-sectional analyses, whereas longitudinal analyses did not confirm the inverse association [2]. Meta-analysis conducted a few years ago concluded that the protective role of smoking in OA development is likely to be false [21]. We did not find a statistically significant difference in the prevalence of hand OA between women who consumed alcohol and those who did not. It was established that ultrasound detected inflammation on a joint level could predict radiographic progression on that joint [22], hence, synovitis presents the risk factor for radiographic progression of OA [23]. The result of the musculoskeletal pain in Ullensaker study analysis had shown that moderate frequency of alcohol consumption was associated with prevalent ultrasound detected synovitis. Hougen et al. reported that moderate alcohol consumption was associated with prevalent hand OA [2]. We must emphasize that the participants in our study were divided into two groups depending on whether they consumed alcohol or not, and they were not classified according to the amount of alcohol they consumed. On the other hand, we cannot exclude the fact that some of the participants did not want to report consuming alcohol. It could be the cause of different results. In this study, we also compared patients with low and moderate physical activity, and there was no statistically significant difference between groups. Studies conducted in the general population have shown that a moderate level of physical activity is not associated with OA [3], but research

| Table 3. Prediction of hand osteoarthritis using multivariate logistic regression |
|---|
| **Wald** | **p** | **OR** | **95% Confidence interval** |
| **Lower limit** | **Upper limit** |
| **Constant/Konstanta** | **Porodična anamneza o strukturnim promenama na zglobovima šaka** | **31.004** | **0.000** | **17.818** | **6.465** | **49.109** |
| **Constant/Konstanta** | **Porodična anamneza o strukturnim promenama na zglobovima šaka** | **26.620** | **0.000** | **15.288** | **5.426** | **43.078** |
| **Metabolic syndrome/Metabolički sindrom** | **3.936** | **0.047** | **3.046** | **1.014** | **9.156** |
| **Constant/Konstanta** | **11.151** | **0.001** | **0.176** |

Discussion

The aim of this study was to compare the association between different risk factors for radiographic hand OA. We found no statistically significant correlation between radiographic hand OA and potential risk factors which include earlier occupation, BMI, smoking, alcohol consumption, physical activity, and time of onset of menopause, duration of menopause, fractures to minor trauma or family history of fractures. The studies that have researched hand OA mostly analyzed occupation-related data for men and women combined. Currently, there are no standardized criteria for assessing the connection between work exposures and OA, which shows that highly diverse criteria were used in the studies. Some of the studies reported strong and moderate evidence for a lack of association among several activities and increased risk of hand OA [15–17] which is in line with our results. Meta-analysis conducted by Hammer et al. provided limited evidence that work activities required repeated and/or sustained pinch grip may increase the risk of the wrist or finger OA. However, the included studies were mostly cross-sectional, and there is a lack of prospective cohort studies [18]. In our research, we found no association between hand OA and overweight which is in line with the Norwegian study on obesity and hand OA [2, 19]. A different result was reported by O’Neil et al. who found that increased BMI is moderately associated with the progression of hand OA. They suggested that overweight/obesity may also increase the risk of progression of OA through systematic factors [20]. There are different definitions

...
has mostly been conducted on the knee joint. The explanation of the increased risk for developing OA among women after menopause has been a challenge for researchers for years [24]. We did not find a statistically significant difference either in relation to the time of onset of menopause or the duration of menopause between the 2 groups. The results of different studies are contradictory. One Australian study suggests that a later age at menopause and longer duration of the interval between menarche and menopause are associated with more severe distal interphalangeal OA, stating that estrogen in the early course of the disease can lead to the development of severe form of OA either symptomatic or radiographic [25].

On the other hand, studies which examined the association between estrogen replacement therapy and hand OA showed different results. One study showed that those who do not take hormone therapy are at higher risk to develop hand OA [26], while another study [27] found no association between hormone replacement therapy and hand OA [24]. The effects of estrogen on the joint level are still not clear enough and future research in this area is required [28]. One Rotterdam study reported that individuals with vertebral fractures had a 74% increased risk of developing radiographic hand OA, and to the contrary, non-vertebral fractures were not associated with the incidence of progression of hand OA [29]. Another result was in line with the result of our study which is likely due to the fact we did not separate the study participants by the location of the previous fracture. The mentioned study suggests, as one of the explanations for a different result in two groups, the fact that individuals with a prevalent vertebral fracture are more dependent on the use of walking aid which increases the risk of hand OA [29]. Our results did not show an association between family history of fractures and the prevalence of hand OA. In their study, Bergin et al. mentioned the possibility of a heritable bone characteristic which affects both vertebral fracture risk and frequency of hand OA [29]. As statistically significant predictors, family history of structural changes in the hands and MetS were distinguished. Genetic factors have a significant role in the development of OA, and heritability of hand OA is more than 60% [10, 30]. The results of our study showed that patients who have a positive family history of structural changes in the hands have a 15 times higher chance of hand OA compared to patients with a negative family history. When it comes to MetS as a predictor of hand OA, there are also disagreements in the foreign research reports. Two Dutch studies which had examined the association between MetS and hand OA reported higher prevalence of MetS among individuals with hand OA [31, 32]. The first showed that overweight persons with diabetes and hypertension had a significantly higher risk of radiographic hand OA, pointing to the metabolic component in the etiology of OA [31]. Our study showed that individuals with MetS had a 3 times higher chance for hand OA compared to subjects without MetS. On the other hand, Marshall et al. established that metabolic risk factors were not associated with higher incidence or progression of hand OA over 7 years, whether observed together or separately [33]. This contradiction could be explained by different study methodologies, and the use of different definitions of MetS. The last-mentioned study included the following metabolic factors: BMI, hypertension, dyslipidemia, and diabetes [33], while in our study we used the clinical definition mentioned in the methodology of these study [14]. However, they have used BMI which is defined on height and weight, so there is no information about the distribution of adipose tissue, whilst we used data relating to waist circumference. One Dutch study reported an association between visceral fat and hand OA in men. It has been suggested that visceral fat secretes bioactive cytokines which likely act locally in joint tissues [34]. Furthermore, we did not consider the influence of individual metabolic factors, so the two studies cannot be compared in that segment. Although intrinsic factors, such as genetic, increase the risk for hand OA, MetS also has a significant role as a modifiable factor which indicates a notable potential for prevention [35]. This original scientific paper is part of a doctoral dissertation: The link between hand functionality in osteoarthritis and bone density in postmenopausal women as measured by central dual-energy X-ray a absorptiometry.

Conclusion

A positive family history of structural changes in the hand is the most significant risk factor for the development of hand osteoarthritis. Likewise, metabolic syndrome presents another important predictor of hand osteoarthritis. Considering the contradictory results of previous studies in relation to other potential predictors, future longitudinal studies are needed.

References

1. Sladojević I, Krivokuća Z, Gajanin V, Manojlović S. Expression of collagen type I in unaltered and osteoarthritic menisci of knee joint. Med Pregl. 2016;69(1-2):16-23.
2. Haugen IK, Magnusson K, Turkiewicz A, Englund M. The prevalence, incidence, and progression of hand osteoarthritis in relation to body mass index, smoking, and alcohol consumption. J Rheumatol. 2017;44(9):1402-9.
3. Neogi T, Zhang Y. Epidemiology of osteoarthritis. Rheum Dis Clin North Am. 2013;39(1):1-19.
4. Magnusson K, Mathiessen A, Hammer H, Kvien T, Slatkowsky-Christensen B, Natvig B, et al. Smoking and alcohol use are associated with structural and inflammatory hand osteoarthritis features. Scand J Rheumatol. 2017;46(5):388-95.
5. Qin J, Barbour KE, Murphy LB, Nelson AE, Schwartz TA, Helmick CG, et al. Lifetime risk of symptomatic hand osteoarthritis: The Johnston County Osteoarthritis Project. Arthritis Rheumatol. 2017;69(6):1204-12.
6. Zvekić-Svorcan J, Igić N. Importance of the thumb. MD Medical data. 2015;4(30):307-10.
7. Lee KS, Jung MC. Ergonomic evaluation of biomechanical hand function. Saf Health Work. 2015;6(1):9-17.
8. Kloopenburg M, Kroon FP, Blanco FJ, Doherty M, Dziedzic KS, Greibrok E, et al. 2018 update of the EULAR recommendations for the management of hand osteoarthritis. Ann Rheum Dis. 2019;78(1):16-24.
9. Castell MV, van der Pas S, Otero A, Siviero P, Dennisson E, Denkinger M, et al. Osteoarthritis and frailty in elderly individuals across six European countries: results from the European Project on OSteoArthritis (EPOSA). BMC Musculoskelet Disord. 2015;16:359.
10. Yucesoy B, Charles LE, Baker B, Burchfield CM. Occupational and genetic risk factors for osteoarthritis: a review. Work. 2015;50(2):261-73.
11. Delgado D, Lombert BS, Boutris N, McCulloch PC, Robbins AB, Moreno MR, et al. Validation of digital visual analog scale pain scoring with a traditional paper-based visual analog scale in adults. J Am Acad Orthop Surg Glob Res Rev. 2018;2(3)388.
12. Kohn MD, Sassoon AA, Fernando ND. Classifications in brief: Kellgren-Lawrence classification of osteoarthritis. Clin Orthop Relat Res. 2016;474(8):1886-93.
13. Altman RD, Gold GE. Atlas of individual radiographic features in osteoarthritis, revised. Osteoarthrits Cartilage. 2007;15 Suppl A:A1-56.
14. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive summary of the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (adult treatment panel III). JAMA. 2001;285(19):2486-97.
15. Gignac MAM, Irvin E, Cullen K, Van Eerd D, Beaton DE, Mahood Q, et al. Men and women's occupational activities and the risk of developing osteoarthritis of the knee, hip or hands: a systematic review and recommendations for future research. Arthritis Care Res. 2020;72(3):378-96.
16. Sayre EC, Li LC, Kopec JA, Esaiaie JM, Bar S, Cibere J. The effect of disease site (knee, hip, hand, foot, lower back or neck) on employment reduction due to osteoarthritis. PLoS One. 2010;5(5): e10470.
17. Caspi D, Flusser G, Farber I, Ribak J, Leibovitz A, Habot B, et al. Clinical, radiologic, demographic, and occupational aspects of hand osteoarthritis in the elderly. Semin Arthritis Rheum. 2001;30(5):321-31.
18. Hammer PEC, Shiri R, Kryger AI, Kirkoskov L, Bonde JP. Associations of work activities requiring pinch or hand grip or exposure to hand-arm vibration with finger and wrist osteoarthritis: a meta-analysis. Scand J Work Environ Health. 2014;40(2):133-45.
19. Magnusson K, Skatowsky-Christensen B, van der Heijide D, Kvien TK, Hagen KB, Haugen IK. Body mass index and progressive hand osteoarthritis: data from the Oslo hand osteoarthritis cohort. Scand J Rheumatol. 2015;44(4):331-6.
20. O’Neill TW, McCabe PS, McBeth J. Update on the epidemiology, risk factors and disease outcomes of osteoarthritis. Best Pract Res Clin Rheumatol. 2018;32(2):312-26.
Rad je priljben 27. VI 2020.
Recenziran 3. VII 2020.
Prijvačen za stampu 7. VII 2020.
BIBLID.0025-8105:(2020):LXXIII:3-4:81-87.