

Original Article



Assessment of quality of life in patients with lower limb osteoarthritis

Kamal Esalatmanesh¹, Roozbeh Esalatmanesh¹, Zahra Soleimani², Dariush Mahmoodian Darvishani¹,
Alireza Khabbazi³, Aida Malek Mahdavi^{3*}

¹Autoimmune Diseases Research Center, Kashan University of Medical Sciences, Kashan, Iran

²Infectious Diseases Research Center, Kashan University of Medical Sciences, Kashan, Iran

³Connective Tissue Diseases Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

Article info

Article History:

Received: 22 June 2021

Accepted: 17 Dec. 2021

e-Published: 29 Oct. 2022

Keywords:

- Lower extremity
- Osteoarthritis
- Quality of life

Abstract

Introduction: Osteoarthritis (OA) is a progressive disease, which directly influences individual's quality of life (QOL). In current study, we decided to assess the QOL in patients with lower limb OA to find an association between patients' QOL and demographic factors.

Methods: In this cross-sectional study, a total of 203 OA patients aged over 50 years and 200 healthy controls matched with regard to age and gender were included. Short Form 12-item Health Survey (SF-12) was used to evaluate QOL.

Results: The mean \pm standard deviation (SD) age of OA patients and control group was 69.82 ± 11.49 and 68.18 ± 10.54 years, respectively. 63% of patients and 56% of control group were females. Most of SF-12 domains including physical functioning, role physical, general health, social functioning, and role emotional were significantly lower in OA patients compared with the control group ($P < 0.05$). Moreover, bodily pain domain was significantly higher in OA patients compared with the control group ($P = 0.038$). There was a considerable correlation between most SF-12 domains with age and sex ($P < 0.05$); whereas considerable correlation was just noticed between role physical domain with body mass index (BMI) ($P < 0.001$). Additionally, Vitality considerably was associated with marital status ($P = 0.038$).

Conclusion: QOL in lower limb OA patients was compared with healthy subjects and this impairment was in association with some demographic factors.

Introduction

Osteoarthritis (OA) is a type of arthritis that affects different joints in the body like hands, knees, spine and hips, causing pain, stiffness, swelling, and physical dysfunction.¹ OA is a main reason of disability in the globe and the number of persons disabled by OA has been increased remarkably.² OA is a progressive disease and the physical characteristics of OA have direct impact on individual's quality of life (QOL).¹

The QOL has been considered as a significant outcome parameter in subjects with chronic health conditions. Determining health-related quality of life (HRQOL) has a significant role in evaluating the course of disease and making treatment decisions. QOL is a concept about having ability to satisfy primary requirements, life satisfaction, presenting sufficient social interaction and interpersonal relationships, considering time to fun, having a good feeling both physically and emotionally, and possessing self-esteem. Thus, it can be depicted as understanding of individuals regarding life, aims, values, and interests.³ Furthermore, assessing QOL is helpful in expanding care programs, which certify a better

knowledge of patients' behaviors as well as problems they expose with the disease and useful coping techniques.⁴ Based on previous reports, QOL in patients with OA was negatively affected by the disease and subjects with OA had lower QOL.⁵⁻¹³

Short Form 12-item Health Survey (SF-12) is one of the most widely used tools for assessing self-reported HRQOL. It is originated from the SF-36, which is also widely accepted and developed to evaluate subjective physical and mental health status.¹⁴ Studies using the SF-12 have ascertained the questionnaire as a valid and reliable measure for evaluating overall health status.^{15,16} SF-12 is suitable for evaluating health status in different diseases including diabetes,¹⁷ rheumatoid arthritis,¹⁸ OA,¹⁹ low back pain,²⁰ and other health-related problems.²¹⁻²⁴ In the current study, we decided to assess the QOL in patients with lower limb OA to find an association between patients' QOL and demographic factors.

Methods

Study design and participants

In the present study, a total of 203 subjects aged over

*Corresponding Author: Aida Malek Mahdavi, Email: aidamalek@gmail.com

50 years with diagnosis of lower limb OA according to the American College of Rheumatology criteria^{25,26} were included by convenience sampling method from the outpatient clinic of rheumatology affiliated to Kashan University of Medical Sciences. The control arm was 200 healthy persons matched (one-to-one concordance) with regard to age and sex. Exclusion criteria were having malignancy, mental illness, other rheumatic diseases, history of hip and/or knee joint surgery, and the use of hypnotics.

Evaluation of QOL

SF-12 scale was used to evaluate the QOL. The SF-12 scale is a shortened form of the 36-item QOL scale and includes 12 questions and 8 scales: physical functioning, role limitations due to physical problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and perceived mental health. Two to six-point scales used for response categories for items and raw scores for items were 1 to 6. Raw scores were then recoded for items (bodily pain, general health, vitality, and one item from mental health), which could be changed to present eight scale scores each varying from 0 (the worst) to 100 (the best). This scoring procedure supposed that item or items related to per scale can be changed or summed without scores standardization or item weighting.^{14,27} Montazeri et al²⁸ translated this scale into Persian language and evaluated its validity and reliability. The Iranian version of SF-12 was a valid and reliable measure of HRQOL and acted well. The internal consistency (to test reliability) showed that all eight SF-12 scales met the minimum reliability standard, the Cronbach's α coefficients were 0.73 and 0.72 for physical and mental component summaries, respectively.²⁸ Known-groups comparison (to test validity) indicated that SF-12 distinguished well between females and males as well as between different age groups and educational levels.²⁸ Also, the Cronbach's α coefficient for the present study was 0.771.

Statistical analysis

SPSS statistical package (SPSS Inc., version 16) was applied for analyzing data. The Kolmogorov-Smirnov test was used for assessing the normality of data. Independent *t* test, One-way analysis, and chi-square test were used for determining differences between groups. Pearson correlation analysis was used for evaluating the correlations between variables. *P* values less than 0.05 were defined as statistical significance.

Results

Characteristics of OA and control arms are presented in Table 1. The mean \pm SD age of participants in the OA and control groups was 69.82 ± 11.49 and 68.18 ± 10.54 years, respectively. 63% of OA group and 56% of control group were females. The mean body mass index (BMI) was

Table 1. Baseline characteristics of OA patients and controls

Characteristics	OA patients (n=203)	Control group (n=200)	<i>P</i> value*
Age (y)	69.82 \pm 11.49	68.18 \pm 10.54	0.136
BMI (kg/m ²)	25.42 \pm 4.22	24.03 \pm 3.35	<0.001
Gender			0.180
Male	75 (37)	87 (44)	
Female	128 (63)	113 (56)	
Level of Education			0.136
Illiterate	69 (34)	50 (25)	
Non-diploma	95 (47)	101 (51)	
Diploma	33 (16)	37 (18)	
Upper-diploma	6 (3)	12 (6)	
Marital status			0.973
Single	13 (6)	11 (5)	
Married	190 (94)	189 (95)	
OA joint			-
Knee	123 (61)	-	
Hip	35 (17)	-	
Both	45 (22)	-	

OA: osteoarthritis; BMI: body mass index.

Data are presented as number (%) or mean \pm SD.

* Independent sample *t* test or chi-square test, as appropriate.

P < 0.05 was considered significant.

significantly different between the two groups (*P* < 0.001); whilst there was no significant in age, sex, level of education and marital status among two arms (*P* > 0.05).

According to Table 2, most of SF-12 domains including physical functioning, role physical, general health, social functioning, and role emotional were significantly lower in OA patients compared to the control group (*P* < 0.05). Moreover, bodily pain domain was significantly higher in OA patients compared to the control group (*P* = 0.038).

In addition, we assessed the correlation between SF-12 scores and demographic characteristics in OA group (Table 3). Age and sex were significantly correlated with the most SF-12 domains; whilst education level and BMI had a significant correlation only with the Role Physical domain. Also, considerable correlation was only noticed between marital status with the mental health (total) score and role emotional (Table 3).

Discussion

The QOL can be affected negatively by OA which is a chronic and debilitating health problem. Based on our study, majority of SF-12 domains were considerably worse in OA arm compared to the control arm indicating that patients with OA had a lower QOL than healthy subjects. The results of our study agreed with that of previous studies.⁵⁻¹³ Martín-Fernández et al⁵ indicated that HRQOL in OA patients was significantly worse than general population and the utility loss due to OA was very high compared to the general population. Another study by Nikolic et al⁶ showed that severity of clinical

Table 2. SF-12 scores of OA patients and controls

	OA patients (n=203)	Control group (n=200)	P value*
Physical Functioning	3.45±1.10	3.91±1.16	<0.001
Role Physical	2.74±1.27	3.17±1.20	0.001
Bodily Pain	3.29±1.48	2.98±1.51	0.038
General Health	2.69±0.76	3.00±0.81	<0.001
Vitality	3.50±1.47	3.24±1.48	0.076
Social Functioning	2.78±1.45	3.19±1.50	0.007
Role Emotional	2.67±0.79	3.05±0.85	<0.001
Mental Health	5.93±1.42	5.76±1.66	0.255
Physical Health	12.62±1.90	12.64±1.73	0.893
Mental Health (Total)	14.91±2.21	15.24±2.51	0.152

OA: osteoarthritis.

Data are presented as mean±SD.

* Independent sample *t* test.

P<0.05 was considered significant.

symptoms and changes in radiographic areas affected the performance and QOL of subjects with knee OA. In the research of Mesci et al,⁷ the depression score of physically active knee OA patients was significantly lower than that of patients with insufficient activity. Moreover, mean SF-36 physical function, physical role, and physical component scores of the physically active group were significantly higher than insufficient activity group.⁷ These authors concluded that high-level physical activity decreased depression and improved QOL and functional capacity in knee OA patients.⁷ Alrushud et al⁸ also showed that knee OA had negative influence on QOL of Saudi elders, whereas healthy elders had significantly a better score on all SF-36 domains. These authors further suggested that mental health was more influenced than physical health.⁸

Moreover, Cook et al⁹ found that USA elders with knee OA had lower QOL levels. Also, Zakaria et al¹⁰ stated that elder patients with knee OA had relatively poor QOL using SF-36 scale. Additional researches by Salaffi et al,¹¹ Muraki et al,¹² and Tangtrakulwanich et al¹³ reported that knee OA negatively affected QOL. It has been indicated that subjects with OA are more probable to consider themselves as “disabled” in comparison with subjects with other chronic health problems,²⁹ which may be attributable to the nature of OA signs and their influence on physical, social, and occupational activities.³⁰ It has been noted that pain may mediate association between OA and QOL.^{31,32} Pain is a main factor in determining loss of function in OA. Individuals with OA have restricted function to prevent from pain-increasing movements.³³ Thus, pain is directly associated with subject’s QOL and contributes to lower scores.

Our study indicated significant correlations between most of SF-12 domains with age and sex, between Role Physical domain with BMI and level of education, and between marital status with mental health (total) score and Role Emotional. The present study was consistent with previous reports³⁴⁻³⁶ that indicated the negative impact of increasing age on QOL in OA patients. In contrast with these findings, there was no correlation between age and QOL subscales in knee OA except in the physical health.³⁷ Similar to our research, in the studies by Rat et al,^{34,38} a significant relationship was reported between sex and domains of pain and social support. This indicates the need for different approaches in men and women to address the problems in these areas of QOL. In addition, a study performed among knee OA subjects regarding HRQOL and gender reported that male participants

Table 3 Relation between SF-12 scores with demographic characteristics in patients with OA (n=203)

Variable	Physical Functioning	Role Physical	Bodily Pain	General Health	Vitality	Social Functioning	Role Emotional	Mental Health	Physical Health	Mental Health (Total)	
Gender	Male	3.74±1.11	2.94±1.17	2.87±1.58	2.88±0.79	3.28±1.65	3.31±1.51	2.85±0.86	5.77±1.49	12.44±1.99	15.21±2.27
	Female	3.28±1.06	3.30±1.21	3.54±1.37	2.59±0.73	3.63±1.34	2.48±1.34	2.58±0.73	6.03±1.37	12.72±1.85	14.72±2.16
	<i>P</i> value*	0.004	0.041	0.002	0.010	0.118	<0.001	0.022	0.213	0.302	0.131
Age	<i>r</i>	0.237	0.140	0.202	-0.133	0.144	-0.180	-0.238	-0.009	0.055	-0.114
	<i>P</i> value**	0.001	0.047	0.004	0.059	0.040	0.010	0.001	0.900	0.434	0.106
BMI	<i>r</i>	-0.108	0.290	-0.024	-0.064	-0.035	-0.051	0.056	-0.028	0.076	-0.055
	<i>P</i> value**	0.125	<0.001	0.734	0.361	0.622	0.469	0.427	0.691	0.279	0.437
Education	Illiterate	3.40±1.05	3.07±1.13	3.27±1.42	2.72±0.82	3.49±1.44	2.65±1.44	2.55±0.70	5.82±1.46	12.48±1.75	14.52±2.20
	Diploma	3.39±1.09	3.24±1.14	3.63±1.39	2.85±0.83	3.45±1.37	2.76±1.50	2.70±0.88	6.48±1.32	13.12±1.80	15.39±2.47
	Upper-diploma	3.83±1.33	3.83±1.60	2.50±1.64	2.67±1.03	3.50±1.51	2.83±1.83	2.67±0.81	5.83±1.72	12.83±2.79	14.83±2.93
	<i>P</i> value***	0.802	0.497	0.311	0.559	0.996	0.773	0.386	0.117	0.405	0.268
Marital status	Single	3.23±1.16	3.38±1.19	3.31±1.49	2.69±0.75	4.23±1.16	2.15±1.34	2.77±0.83	5.92±1.50	12.61±1.71	15.08±1.84
	Married	3.47±1.10	3.16±1.20	3.29±1.49	2.70±0.77	3.45±1.48	2.83±1.46	2.67±0.79	5.94±1.42	12.62±1.92	14.89±2.24
	<i>P</i> value*	0.454	0.513	0.976	0.972	0.038	0.105	0.674	0.973	0.992	0.775

Data are presented as mean±SD.

* Independent sample *t* test; ** Pearson correlation; *** ANOVA.

possessed better scores in most of the domain particularly in physical functioning.¹⁰ Gorial et al³⁹ indicated a significant negative correlation between the level of education and HRQOL in knee OA patients which was in line with our research. Similar findings also revealed that low educational level was linked with the impaired QOL and increased symptomatic knee OA.^{40,41} Kawano et al⁴² also found an association between education level and QOL in knee OA subjects. Similarly, Sutbeyaz et al⁴³ found that health related QOL was considerably impaired in the obese knee OA subjects in comparison with the healthy obese ones, particularly concerning physical facets of daily life and proposed that obesity and knee OA might cause additional attenuation in QOL, which might be due to the effects of being overweight on exacerbating pain. Another research by Zakaria and colleagues¹⁰ reported that patients with higher BMI had lower QOL scores except in social functioning. In contrast, Pang et al⁴⁴ did not show any correlation among BMI and any of the HRQOL in knee OA except general health satisfaction. Some discrepancies between results may be attributed to the differences in the studied subjects.

The limitation of this research was its cross-sectional design and that the questionnaire was not specific to these patients. The strength points of the current research were the relatively large size of samples and having a control arm to compare the QOL between OA patients and normal individuals. In addition, all participants had a good cooperation in the current investigation.

Conclusion

QOL was impaired in lower limb OA patients compared to the healthy subjects and this impairment was associated with some demographic factors.

Acknowledgments

The authors wish to thank all subjects for their participation in this study.

Authors' Contribution

Study design and supervision, KE; Data acquisition, KE, RE, ZS, DMD, AKH; Data analysis and interpretation, DMD, AKH, AMM; Drafting the manuscript, AMM. Revising the manuscript, KE, DMD, AKH, AMM. All authors read and approved the final version of the manuscript.

Study Highlights

What is current knowledge?

- Patients with OA had a lower QOL than healthy subjects.

What is new here?

- QOL impairment was associated with some demographic factors such as age, sex, education level, BMI, and marital status.

Funding

This study was supported by Research Vice-Chancellor of Kashan University of Medical Sciences, Kashan, Iran.

Ethical Approval

The research protocol was approved by the Ethics Committee of Kashan University of Medical Sciences (Ethics code: IR.KAUMS.MEDNT.REC.1399.084) and performed according to the *Declaration of Helsinki* (2008). The purpose of the research was explained to all the participants and written informed consents were obtained. Furthermore, participants were assured that their information would remain confidential.

Conflict of interest

No conflict of interests was reported.

References

1. Krasnokutsky S, Attur M, Palmer G, Samuels J, Abramson SB. Current concepts in the pathogenesis of osteoarthritis. *Osteoarthritis Cartilage*. 2008;16 Suppl 3:S1-3. doi: [10.1016/j.joca.2008.06.025](https://doi.org/10.1016/j.joca.2008.06.025).
2. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390(10100):1211-59. doi: [10.1016/s0140-6736\(17\)32154-2](https://doi.org/10.1016/s0140-6736(17)32154-2).
3. Khabbazi A, Ebrahimzadeh Attari V, Asghari Jafarabadi M, Malek Mahdavi A. Quality of life in patients with Behçet disease and its relation with clinical symptoms and disease activity. *Reumatol Clin (Engl Ed)*. 2021;17(1):1-6. doi: [10.1016/j.reuma.2019.03.002](https://doi.org/10.1016/j.reuma.2019.03.002).
4. Acaray A, Pınar R. Evaluation of chronic hemodialysis patients QOL. *Cumhuriyet Üniversitesi Hemşirelik Yüksek Okulu Dergisi*. 2004;8(1):1-11.
5. Martín-Fernández J, García-Maroto R, Bilbao A, García-Pérez L, Gutiérrez-Teira B, Molina-Siguero A, et al. Impact of lower limb osteoarthritis on health-related quality of life: a cross-sectional study to estimate the expressed loss of utility in the Spanish population. *PLoS One*. 2020;15(1):e0228398. doi: [10.1371/journal.pone.0228398](https://doi.org/10.1371/journal.pone.0228398).
6. Nikolic G, Nedeljkovic B, Trajkovic G, Rasic D, Mirkovic Z, Pajovic S, et al. Pain, physical function, radiographic features, and quality of life in knee osteoarthritis agricultural workers living in rural population. *Pain Res Manag*. 2019;2019:7684762. doi: [10.1155/2019/7684762](https://doi.org/10.1155/2019/7684762).
7. Mesci E, Icagasioglu A, Mesci N, Turgut ST. Relation of physical activity level with quality of life, sleep and depression in patients with knee osteoarthritis. *North Clin Istanbul*. 2015;2(3):215-21. doi: [10.14744/nci.2015.95867](https://doi.org/10.14744/nci.2015.95867).
8. Alrushud AS, El-Sobkey SB, Hafez AR, Al-Ahaideb A. Impact of knee osteoarthritis on the quality of life among Saudi elders: a comparative study. *Saudi J Sports Med*. 2013;13(1):10-6. doi: [10.4103/1319-6308.112207](https://doi.org/10.4103/1319-6308.112207).
9. Cook C, Pietrobon R, Hegedus E. Osteoarthritis and the impact on quality of life health indicators. *Rheumatol Int*. 2007;27(4):315-21. doi: [10.1007/s00296-006-0269-2](https://doi.org/10.1007/s00296-006-0269-2).
10. Zakaria ZF, Bakar AA, Hasmoni HM, Rani FA, Kadir SA. Health-related quality of life in patients with knee osteoarthritis attending two primary care clinics in Malaysia: a cross-sectional study. *Asia Pac Fam Med*. 2009;8(1):10. doi: [10.1186/1447-056x-8-10](https://doi.org/10.1186/1447-056x-8-10).

11. Salaffi F, Carotti M, Grassi W. Health-related quality of life in patients with hip or knee osteoarthritis: comparison of generic and disease-specific instruments. *Clin Rheumatol.* 2005;24(1):29-37. doi: [10.1007/s10067-004-0965-9](https://doi.org/10.1007/s10067-004-0965-9).
12. Muraki S, Akune T, Oka H, En-Yo Y, Yoshida M, Saika A, et al. Impact of knee and low back pain on health-related quality of life in Japanese women: the Research on Osteoarthritis Against Disability (ROAD). *Mod Rheumatol.* 2010;20(5):444-51. doi: [10.1007/s10165-010-0307-5](https://doi.org/10.1007/s10165-010-0307-5).
13. Tangtrakulwanich B, Chongsuvivatwong V, Geater AF. Comparing quality of life among people with different patterns and severities of knee osteoarthritis. *J Musculoskelet Res.* 2006;10(1):47-55. doi: [10.1142/s0218957706001650](https://doi.org/10.1142/s0218957706001650).
14. Ware J Jr, Kosinski M, Keller SD. A 12-item short-form health survey: construction of scales and preliminary tests of reliability and validity. *Med Care.* 1996;34(3):220-33. doi: [10.1097/00005650-199603000-00003](https://doi.org/10.1097/00005650-199603000-00003).
15. Jenkinson C, Layte R. Development and testing of the UK SF-12 (short form health survey). *J Health Serv Res Policy.* 1997;2(1):14-8. doi: [10.1177/135581969700200105](https://doi.org/10.1177/135581969700200105).
16. Andrews G. A brief integer scorer for the SF-12: validity of the brief scorer in Australian community and clinic settings. *Aust N Z J Public Health.* 2002;26(6):508-10. doi: [10.1111/j.1467-842x.2002.tb00357.x](https://doi.org/10.1111/j.1467-842x.2002.tb00357.x).
17. Monteagudo Piqueras O, Hernando Arizaleta L, Palomar Rodríguez JA. [Reference values of the Spanish version of the SF-12v2 for the diabetic population]. *Gac Sanit.* 2009;23(6):526-32. doi: [10.1016/j.gaceta.2008.11.005](https://doi.org/10.1016/j.gaceta.2008.11.005).
18. Linde L, Sørensen J, Østergaard M, Hørslev-Petersen K, Rasmussen C, Jensen DV, et al. What factors influence the health status of patients with rheumatoid arthritis measured by the SF-12v2 Health Survey and the Health Assessment Questionnaire? *J Rheumatol.* 2009;36(10):2183-9. doi: [10.3899/jrheum.090134](https://doi.org/10.3899/jrheum.090134).
19. Gandhi SK, Salmon JW, Zhao SZ, Lambert BL, Gore PR, Conrad K. Psychometric evaluation of the 12-item short-form health survey (SF-12) in osteoarthritis and rheumatoid arthritis clinical trials. *Clin Ther.* 2001;23(7):1080-98. doi: [10.1016/s0149-2918\(01\)80093-x](https://doi.org/10.1016/s0149-2918(01)80093-x).
20. Luo X, George ML, Kakouras I, Edwards CL, Pietrobon R, Richardson W, et al. Reliability, validity, and responsiveness of the short form 12-item survey (SF-12) in patients with back pain. *Spine (Phila Pa 1976).* 2003;28(15):1739-45. doi: [10.1097/01.brs.0000083169.58671.96](https://doi.org/10.1097/01.brs.0000083169.58671.96).
21. Yang M, Wallenstein G, Hagan M, Guo A, Chang J, Kornstein S. Burden of premenstrual dysphoric disorder on health-related quality of life. *J Womens Health (Larchmt).* 2008;17(1):113-21. doi: [10.1089/jwh.2007.0417](https://doi.org/10.1089/jwh.2007.0417).
22. Sutton D, Raines DA. Health-related quality of life following a surgical weight loss intervention. *Appl Nurs Res.* 2010;23(1):52-6. doi: [10.1016/j.apnr.2008.01.001](https://doi.org/10.1016/j.apnr.2008.01.001).
23. McBride O, Adamson G, Bunting BP, McCann S. Assessing the general health of diagnostic orphans using the short form health survey (SF-12v2): a latent variable modelling approach. *Alcohol Alcohol.* 2009;44(1):67-76. doi: [10.1093/alcalc/agn083](https://doi.org/10.1093/alcalc/agn083).
24. Sloan RA, Sawada SS, Martin CK, Church T, Blair SN. Associations between cardiorespiratory fitness and health-related quality of life. *Health Qual Life Outcomes.* 2009;7:47. doi: [10.1186/1477-7525-7-47](https://doi.org/10.1186/1477-7525-7-47).
25. Altman R, Asch E, Bloch D, Bole G, Borenstein D, Brandt K, et al. Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. *Arthritis Rheum.* 1986;29(8):1039-49. doi: [10.1002/art.1780290816](https://doi.org/10.1002/art.1780290816).
26. Altman R, Alarcón G, Appelrouth D, Bloch D, Borenstein D, Brandt K, et al. The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hip. *Arthritis Rheum.* 1991;34(5):505-14. doi: [10.1002/art.1780340502](https://doi.org/10.1002/art.1780340502).
27. Ware JE, Kosinski M, Keller SD. SF-12: How to Score the SF-12 Physical and Mental Health Summary Scales. Lincoln, RI: QualityMetric Inc; 1998.
28. Montazeri A, Vahdaninia M, Mousavi SJ, Omidvari S. The Iranian version of 12-item short form health survey (SF-12): factor structure, internal consistency and construct validity. *BMC Public Health.* 2009;9:341. doi: [10.1186/1471-2458-9-341](https://doi.org/10.1186/1471-2458-9-341).
29. Verbrugge LM, Juarez L. Profile of arthritis disability. *Public Health Rep.* 2001;116(Suppl 1):157-79. doi: [10.1093/phr/116.S1.157](https://doi.org/10.1093/phr/116.S1.157).
30. Yildiz N, Topuz O, Gungen GO, Deniz S, Alkan H, Ardıc F. Health-related quality of life (Nottingham Health Profile) in knee osteoarthritis: correlation with clinical variables and self-reported disability. *Rheumatol Int.* 2010;30(12):1595-600. doi: [10.1007/s00296-009-1195-x](https://doi.org/10.1007/s00296-009-1195-x).
31. Sanghi D, Avasthi S, Mishra A, Singh A, Agarwal S, Srivastava RN. Is radiology a determinant of pain, stiffness, and functional disability in knee osteoarthritis? A cross-sectional study. *J Orthop Sci.* 2011;16(6):719-25. doi: [10.1007/s00776-011-0147-y](https://doi.org/10.1007/s00776-011-0147-y).
32. Laslett LL, Quinn SJ, Winzenberg TM, Sanderson K, Cicuttini F, Jones G. A prospective study of the impact of musculoskeletal pain and radiographic osteoarthritis on health related quality of life in community dwelling older people. *BMC Musculoskelet Disord.* 2012;13:168. doi: [10.1186/1471-2474-13-168](https://doi.org/10.1186/1471-2474-13-168).
33. Brooks JA, Kesler KA, Johnson CS, Ciaccia D, Brown JW. Prospective analysis of quality of life after surgical resection for esophageal cancer: preliminary results. *J Surg Oncol.* 2002;81(4):185-94. doi: [10.1002/jso.10175](https://doi.org/10.1002/jso.10175).
34. Rat AC, Pouchot J, Coste J, Baumann C, Spitz E, Retel-Rude N, et al. Development and testing of a specific quality-of-life questionnaire for knee and hip osteoarthritis: OAKHQOL (Osteoarthritis Knee and Hip Quality of Life). *Joint Bone Spine.* 2006;73(6):697-704. doi: [10.1016/j.jbspin.2006.01.027](https://doi.org/10.1016/j.jbspin.2006.01.027).
35. Serhier Z, Harzy T, S EL, Diouny S, El Rhazi K, Bennani Othmani M, et al. Cross-cultural adaptation and validation of the knee and hip health-related quality of life (OAKHQOL) in a Moroccan Arabic-speaking population. *Rheumatol Int.* 2012;32(4):1015-23. doi: [10.1007/s00296-010-1781-y](https://doi.org/10.1007/s00296-010-1781-y).
36. Robinson ME, Gagnon CM, Riley JL, 3rd, Price DD. Altering gender role expectations: effects on pain tolerance, pain threshold, and pain ratings. *J Pain.* 2003;4(5):284-8. doi: [10.1016/s1526-5900\(03\)00559-5](https://doi.org/10.1016/s1526-5900(03)00559-5).
37. Alkan BM, Fidan F, Tosun A, Ardıçoğlu O. Quality of life and self-reported disability in patients with knee osteoarthritis. *Mod Rheumatol.* 2014;24(1):166-71. doi: [10.3109/14397595.2013.854046](https://doi.org/10.3109/14397595.2013.854046).
38. Rat AC, Coste J, Pouchot J, Baumann M, Spitz E, Retel-Rude N, et al. OAKHQOL: a new instrument to measure quality of life in knee and hip osteoarthritis. *J Clin Epidemiol.* 2005;58(1):47-55. doi: [10.1016/j.jclinepi.2004.04.011](https://doi.org/10.1016/j.jclinepi.2004.04.011).
39. Gorial FI, Anwer Sabah SA, Kadhim MB, Jamal NB. Functional status in knee osteoarthritis and its relation to demographic and clinical features. *Mediterr J Rheumatol.* 2018;29(4):207-10. doi: [10.31138/mjr.29.4.207](https://doi.org/10.31138/mjr.29.4.207).

40. Callahan LF, Shreffler J, Siaton BC, Helmick CG, Schoster B, Schwartz TA, et al. Limited educational attainment and radiographic and symptomatic knee osteoarthritis: a cross-sectional analysis using data from the Johnston County (North Carolina) osteoarthritis project. *Arthritis Res Ther.* 2010;12(2):R46. doi: [10.1186/ar2956](https://doi.org/10.1186/ar2956).
41. Callahan LF, Cleveland RJ, Shreffler J, Schwartz TA, Schoster B, Randolph R, et al. Associations of educational attainment, occupation and community poverty with knee osteoarthritis in the Johnston County (North Carolina) osteoarthritis project. *Arthritis Res Ther.* 2011;13(5):R169. doi: [10.1186/ar3492](https://doi.org/10.1186/ar3492).
42. Kawano MM, Araújo IL, Castro MC, Matos MA. Assessment of quality of life in patients with knee osteoarthritis. *Acta Ortop Bras.* 2015;23(6):307-10. doi: [10.1590/1413-785220152306150596](https://doi.org/10.1590/1413-785220152306150596).
43. Sutbeyaz ST, Sezer N, Koseoglu BF, Ibrahimoglu F, Tekin D. Influence of knee osteoarthritis on exercise capacity and quality of life in obese adults. *Obesity (Silver Spring).* 2007;15(8):2071-6. doi: [10.1038/oby.2007.246](https://doi.org/10.1038/oby.2007.246).
44. Pang J, Cao YL, Zheng YX, Gao NY, Wang XZ, Chen B, et al. Influence of pain severity on health-related quality of life in Chinese knee osteoarthritis patients. *Int J Clin Exp Med.* 2015;8(3):4472-9.