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Physical and Mental Components of SF-36 in Knee Osteoarthritis: A Case-Control Study Correlating Each Domain with the Clinical- Radiological Severity

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ABSTRACT

Background: Knee osteoarthritis (KOA) significantly affects the quality of life (QoL). The QoL in KOA declines progressively and concomitantly with the grade of disease progression. Thus, it becomes an important outcome in subjects with KOA. **Objectives:** To compare the QoL of KOA subjects with healthy subjects using the Short-Form Health Survey (SF-36) and to correlate each domain of SF-36 with clinical and radiological severity of the disease. **Methods:** Ninety subjects with KOA and forty healthy subjects were enrolled. Physical and mental health components of QoL under 8 specified SF-36 domains were assessed. Clinical severity was assessed by WOMAC and VAS scores. Kellgren & Lawrence grading (X-ray) and articular cartilage volume (MRI) were used to assess radiological severity. **Results:** Physical health components had a lower score than mental health. General health was the most affected domain and role limitations due to emotional problems domain was the least affected. VAS score was significantly correlated with all the eight domains of SF-36. WOMAC pain with 5/8 domains and total WOMAC with 2/8. KL grade had a significant association with 6/8 domains whereas ACV correlated with only 4/8. **Conclusion:** Age, gender, BMI and level of education are not true determinants of QoL in KOA. In QoL evaluation, the VAS score for knee pain and KL grade remain the best cognitive factors whereas WOMAC scores and ACV are cumbersome, time consuming and insignificant. The physical component of SF-36 is more involved than the mental component in KOA.

INTRODUCTION

Knee osteoarthritis (KOA) has significant detrimental effects on the quality of life (QoL).[1,2] In India, more than 56.6% of the population older than 65 years suffers from KOA.[3] It is estimated that by 2025, the prevalence of KOA worldwide will increase by 40% due to the aging of the world population. The rapid increase in the prevalence of this already common disease suggests that KOA will have a growing impact on the health care system shortly.[4] Due to the nature of the disease and its impact on social, occupational, and physical activities, OA patients self- identify themselves as disabled.[5,6] QoL is an important measure of a patient's perception of illness and is influenced by diverse heterogeneous variables.[7] Thus, it becomes an important outcome in subjects with KOA. The QoL is significantly impacted by the disease as it is the major cause of disability in both developed and developing world.[8] This study evaluated QoL in subjects with KOA using the Medical Outcomes Study 36 - Item Short-Form Health Survey (SF-36) and correlated each domain of SF-36 with the clinical and radiological severity of KOA.

MATERIALS AND METHODS

This study was conducted on 90 subjects diagnosed with KOA and 40 subjects without KOA. The Institutional Ethics Committee approved the study. The procedures followed were by the ethical standards of the ethics committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000.

Study design: This is a case-control study. Individuals were recruited by sequential non-probability sampling from those who met the inclusion criteria.

Inclusion criteria: Individuals of either gender with a medical diagnosis of unilateral or bilateral KOA who agreed to sign the written informed consent. The subjects were screened for KOA as per the following guidelines of ACR:

A) Knee pain with osteophytes on X-ray

B) One of the following:

i) Crepitus on knee range of motion

ii) Age 50 years or older

iii) Morning stiffness of short duration (< 30 mins)

Exclusion criteria: Individuals with secondary KOA, such as gout, infection, trauma, congenital & developmental disorders affecting knee joint, central nervous system alteration, cognitive impairment, previous knee surgeries or other diseases associated with the osteoarticular system (rheumatic or, metabolic bone diseases, etc.) were excluded. Furthermore, subjects with degenerative diseases, which could affect their QoL and functional independence, such as cancer, cardiovascular diseases, Alzheimer's, Parkinson's disease, etc., were also excluded from this study.

Radiological imaging (weight-bearing anteroposterior view) of the reference knee was performed. In subjects with bilateral KOA, the left knee was chosen for analysis and termed as reference knee. In unilateral KOA subjects, the knee with clinical symptoms was similarly imaged. Radiographs were evaluated for severity as per the Kellgren & Lawrence grading system. Each subject had MRI of the same knee upon which X-ray was performed to measure articular cartilage volume (ACV). Knees were imaged on 1.5 Tesla whole-body magnetic resonance units using a commercial transmit-receive extremity coil. The parameters used for imaging via3D FSPGR sequence were as follows: flip angle- 90^{o}, repetition time- 40ms, echo time- 82.7ms, the field of view- 16x16cm, in-plane resolution- 352x256 pixels, one acquisition time- 2min30sec, partition thickness- 4mm, bandwidth- 31.2kHz. ACV was measured manually by image processing on an independent workstation using a semi-automated machine GE Signa Excite Advance 4.5.

The self-reported pain, stiffness, and physical function were assessed using subscales of the Western Ontario and McMaster Universities (WOMAC) index along with total WOMAC scores in subjects with KOA. Visual Analogue Scale (VAS) scores on a scale of 0-10 were also used for knee pain assessment.

The evaluation of QoL of the subjects was done using the Medical Outcomes Study 36 - Item Short-Form Health Survey (SF-36). This instrument consists of 36 items, grouped into eight domains: Physical Function (PF), Role Limitations due to Physical Health (RLPH), Role Limitations due to Emotional Problems (RLEP), Energy/ Fatigue (E/F), Emotional Wellbeing (EWB), Social Functioning (SF), Pain, and General Health (GH).

Statistical analysis

Data were represented as either Mean+Standard Deviation (SD) or percentage (%) with a 95% confidence interval (CI) at a 5% level of significance. Two independent groups were compared using student t-test and categorical variables were compared using the Chi-square test. Pearson's correlation coefficient was used to correlate the variables. One-way Analysis of Variance (ANOVA) was used to compare more than two groups. The analyses were performed using statistical software SPSS version 16.0. The power of the study was 80%.

RESULTS

General characteristics of KOA subjects (cases) and subjects without KOA (controls) are given in Table-1. Clinical and radiological profiles of KOA subjects are given in Table-2. Table-3 clearly shows better QoL scores for controls than KOA subjects. GH domain showed the lowest percentage and seems to be the most affected followed by RLPH, PF, E/F, pain, EWB, SF, and RLEP in KOA subjects. The percentages of physical and mental health groups in our cases were significantly higher than their respective controls. The composite physical and mental components of QoL domains showed that physical health had lower percentages than mental health in both case and control groups (Table-4). The association of QoL with clinical and radiological parameters was assessed in KOA subjects. Six out of eight domains (PF, RLPH, RLEP, E/F, pain and GH) exhibited significant association with KL grade 2, 3 & 4 (Table-5). The mean ACV of the subjects was 4.39+1.47 cm^3 (Table-1) and was significantly correlated with PF, RLPH, E/F, and GH domains. VAS score for knee pain was the only clinical variable which showed a significant correlation with all the eight domains of QoL. WOMAC pain showed a significant correlation with PF, RLEP, E/F, EWB, and SF domains. WOMAC stiffness was not related to any of the domains. WOMAC physical function was significantly related to E/F domain only. Total WOMAC scores showed a significant correlation with E/F and SF domains (Table-6).

The association of QoL with gender was also assessed in KOA subjects and a significant difference was observed between genders with females having lower scores in seven out of eight domains viz; PF, RLPH, E/F, EWB, SF, pain and GH (Table-7). Further, to examine the co-dependency of variables, a multivariable regression analysis was performed using SF-36 domains as the dependent variable. Age, height, weight, BMI, KL grade, ACV, VAS score, WOMAC pain, stiffness, and physical function scores were set as independent variables. The

multivariable regression analysis showed that independent variables collectively affect QoL ($p < 0.001$) whereas the VAS score was the only variable exerting an independent effect on seven out of eight domains (PF, RLPH, RLEP, E/F, pain, SF and GH. Age and WOMAC stiffness score did not affect any of the eight domains and did not predict QoL individually (Table-8).

The association of QoL with the level of education in KOA subjects was significant only in the E/F ($p=0.003$) domain.

DISCUSSION

This study was conducted to investigate the impact of KOA on QoL in a population already compromised due to aging and to determine which domain and component of SF-36 were most affected by the disease. The disease affected all the eight domains of SF-36 in KOA subjects with GH being most affected and RLEP the least. The physical components are more affected than the mental components. This negative impact of KOA in our population is consistent with other studies conducted in different countries. Alrushud et al., (2014)[9]reported lower SF-36 scores in KOA subjects for both physical and mental components in comparison to a control group; however, in comparison to our study, the average mental score was lower than the average physical score in that population. Several other studies conducted worldwide have shown that individuals with KOA have relatively poor QoL. [10-15] However, a study was done by Dominick et al. (2004)[16] showed contradictory results where no significant difference was found in QoL scores between subjects with OA and those without OA.

Age

Whereas the role of age in KOA remains undisputed and the effect of age in the perception of QoL is complex and poorly defined, the inter-relation of age and KOA on QoL is further perplexing. This study attempted to explore this. Lower scores were observed in all eight domains of Qol in KOA subjects in comparison to those without KOA. The homogeneity of the subjects' characteristics in our two groups and the marked difference in SF-36 scores strongly points towards the disease and not the age-related changes, to have a significant effect on QoL.

Nevertheless, aging is not inevitably associated with OA and poor QoL.[17] Grushko et al (1988)[18] also showed that changes in the biochemical and biophysical properties of

osteoarthritic cartilage differ from age-related changes in cartilage. In another study, Chaco´n et al., (2004)[12] assessed the QoL in KOA subjects using a Spanish-translated version of the Arthritis Impact Measurement Scales (AIMS) and reported a significant correlation of age with AIMS total score (p=0.02). In our study, a significant negative correlation of age was observed with PF, RLPF and energy domains of QoL. It is important to note that the multiple regression model using the physical function as a dependent variable showed that age is not a significant independent predictor of the disease. The lack of a significant correlation was similarly reported by several other studies[19, 20], whereas one study did find age to be a predictor for diminished PF.[21]

Gender

The demographic profile of subjects with KOA showed a higher fraction of females (68.88%). This data corroborates with other published literature that KOA has higher levels of incidence and prevalence in female populations compared to male populations.[22-24] The Framingham study (1995) also found that symptomatic KOA was almost twice as likely (RR, 1.96; 95% CI, 1.01-3.82) to develop in women than in men.[25] QoL domains were studied in both the genders and significantly lower scores were found in female participants with KOA in comparison to males in seven out of eight domains. This finding is also confirmed by other studies.[20, 21, 26] Hormonal factors, socio-economic status, physical activity, and lifestyle have been reported for this disparity. However, no significant difference was found in QoL between both the genders in a cross-sectional study conducted by Kawano et al (2015).[23]

Level of Education

Education is a crucial variable and a prominent outcome predictor in chronic diseases such as KOA. An association between low education and prevalence of KOA has already been reported. However, correlating the level of education with QoL in KOA subjects yielded interesting results. Whereas several researchers have reported a significant association of QoL with the level of education in a given population, our study did not found so. It was only the energy domain that showed a significant negative correlation with the level of education. A study conducted in Malaysia by Zakariaet al[11] showed that background education is an important factor associated with vitality and RLEP domains. Kawano et al found a statistically significant association of educational status with functional capacity, pain, and functional limitation domains of QoL.[23] Alkan et al reported poor QoL in 70% KOA subjects

who had low-middle education.[26] Jhun et al found a two-fold increase in the probability of OA, leading to the low perception of QoL with low educational status.[27] Similar findings were reported by Hannanet al[28] and Creamer et al[29]. Contrary to the above findings, we found that except energy (p=0.003) none of the other domains of QoL had a significant association with the level of education in our KOA subjects. Determining why the level of education in our cohort of KOA subjects did not influence QoL warrants further research. A possible explanation could be that educated subjects have higher expectations and are more demanding whereas the less educated are tolerant and compromising. Furthermore, is it the interplay of factors like caste, creed, religion, race, ethnicity, culture or the fact that the occupations and lifestyle of the majority of our subjects were similar?

Physical and mental components

Physical health is compromised in subjects of KOA due to pain and disability. The current study showed that all the subjects with KOA had relatively lower scores in both components compared to those without KOA demonstrating that both physical and mental health is significantly affected; however, in the physical component, the scores were further lower compared to the mental component. Lower scores in the physical health component have also been reported by Zakaria et al.,[11], de Bock GH et al.,[30], Lam et al., [31], although they had used different assessment tools. The relatively higher mental component score or better mental health status could be due to the perception, adaptation, and tolerance of the symptoms associated with this chronic disease. Other possible reasons could be coping mechanisms or social resources, which help them, maintain a healthier mental status. Affleck et al.,[32] studied the coping styles and mood changes in KOA and RA subjects. They mentioned that as KOA is considered a normal phenomenon of aging, the subjects consequently start adjusting their health and activity-related expectations with less resistance to match the demands of the illness.[33]

Conversely, there are studies, which found results that conflict with ours. The outcome of studies by Alrushud et al.,[9], Cock et al.,[10], Tangtrakulwaniceet al.,[34] showed better physical health scores than mental health scores and reported that participants were more likely to report mental health problems. Frioui et al.,[35] studied QoL in subjects with KOA by using the scale of Osteoarthritis of the Lower Limbs and Quality of Life (OAKHQOL)" under 5 dimensions viz, Physical Activities, Mental Health, Pain, Social Support, Social Activities. The score of the mental health dimension was the most altered, proving that KOA hurt the

psychology of patients. The reason for this disparity could be the concept that pain and disability in KOA may lead to depression and anxiety in their population. An alternative explanation could be a poor patient adaptation to the imposed limitations caused by the disease.

Disease duration

The mean disease duration of subjects was 2.57+2.76 years ranging between 6 months and 7 years. The duration of disease was not significantly correlated with QoL domains. This may be because of shorter disease duration and younger age of subjects. A similar observation had been reported by Yilidiz et al.[5] In contrast, Alrushud et al.,[9] found a moderate negative correlation of disease duration with the mental component of SF-36. The difference in findings could be because of the longer duration of disease (11.32 years) and age difference (63.9 years) than in our study. Moreover, Zakaria et al (2009) found a negative correlation with all the domains of QoL. The difference in disease duration and age of participants was also present here.[11]

Clinical and Radiological scores

QoL is an important factor in an aging population with KOA. To refine this variable, we investigated which clinical and/or radiological features would best correlate with QoL. This led us to examine correlations of clinical features, KL grades, and ACV on QoL in KOA subjects.

Various studies have demonstrated that OA influences different domains of QoL, such as sleep interruption[36,37], psychological stress[38], reduced independence[39], poorer perceived health[40], and increased healthcare utilization.

Pain is the most crucial element of function loss in OA subjects who try to restrict movements that aggravate pain.[41] It hurts the wellbeing of patients, irrespective of the stage of the disease. This pain is directly related to the subject's QoL and leads to lower its score.[9, 42] The subjects with KOA in our study had 50%of maximum scores in the pain domain whereas subjects without KOA had 78%. A study on Saudi elders compared the QoL status of KOA subjects with healthy individuals and demonstrated that patients with KOA had 44% of maximum pain score while healthy individuals scored 97.5%.[9] Another study by Hopman-

Rock et al. in Netherland found significantly lower QoL values with more chronic pain in a community of elderly people when compared to a reference group.[43]

We assessed clinical features in KOA subjects with QoL using VAS score for knee pain and WOMAC scores for pain, stiffness, and physical disability. VAS scores significantly correlated with all the domains of QoL while WOMAC pain scores correlated with five out of the eight domains, WOMAC physical function with one domain, and WOMAC stiffness with none. Pain, therefore, remains the preponderant and the only clinical feature influencing QoL in subjects with KOA.

In this study, we found that KL grades significantly affected six out of eight domains of QoL in individuals with KOA. A study conducted in Brazil showed that subjects in advanced stages of KOA had worse functional capacity scores.[23] These findings reinforce previous studies, which also explicitly state that individuals with a greater degree of radiological OA had a low perception of QoL.[12,27,44] However, the KL grades do not correlate with individual disease symptoms. It has been observed that pain, stiffness, and disability in KOA do not correlate with radiological changes on X-Ray and this discordance has long been debated.[45] Some subjects experience little or no discomfort even when their radiographs show advanced OA. Conversely, some patients suffer from significant pain with compromised QoL even before the disease has progressed enough to exhibit radiological changes on their X-rays. Why is there such a discrepancy? Although many explanations have been offered, the interplay between structural changes in the articular cartilage influencing adjoining peripheral and central pain processing mechanisms resulting in poor QoL cannot be ruled out.[46]Therefore, to investigate this hypothesis, ACV in KOA subjects was included as another radiological feature in this study. A significant difference in ACV of healthy subjects and KOA has already been reported.[47]; however, there is no study to determine the effect of ACV on QoL. We studied all the eight domains of SF-36 about ACV in KOA subjects. ACV significantly correlated with only four domains in comparison to six with KL grades, thereby rejecting our hypothesis and suggesting that KL grade is a better predictor of QoL over ACV. This finding is fortunately rewarding also in terms of cost-effective KL grading in comparison to expensive and cumbersome ACV calculations.

The multivariable regression analysis performed using SF-36 domains as a dependent variable showed that the VAS score for knee pain is the most influencing independent variable, which affects QoL (except EWB domain) in subjects with KOA. The results of

Chacon et al (2004) coincide with our study findings. They have mentioned that knee pain (assessed by VAS score) is the only variable with an independent effect on QoL as assessed by Arthritis Impact Measurement Scale (AIMS).[12]

Finally, to account for which clinical and radiological feature best correlates with QoL in KOA subjects, we found that VAS correlated with all the eight domains (8/8), KL grade with 6/8, WOMAC pain score with 5/8 and ACV with 4/8. PF and E/F domains were predominant with all and RLPF, RLEH, GH with 3 of the 4 clinical and radiological variables studied. These findings suggest that pain is more important than KL grades in predicting the outcome.

CONCLUSION

SF-36 remains a gold-standard to assess the QoL of people with a long-standing disease like KOA or to make comparisons between healthy and unhealthy. KOA affects all eight domains of SF-36 with GH being the most affected and the physical component is more affected than the mental component. Age, BMI, gender, level of education and duration of illness only relatively influence QoL in KOA subjects in comparison to clinical and radiological scores. VAS score for knee pain is the only clinical variable showing a significant correlation with all the domains of QoL. Knee pain is the paramount determinant of QoL followed by KL grades. ACV least determines the QoL in KOA.

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Table Legends:

Table-1: General Characteristics

Table-2: Clinico-radiological profile of cases

Table-3: Mean Scores and percentages of Short form-36 (SF-36) domains in cases and controls

Table-4: Comparison between components of SF-36 in cases and controls

Table-5: Association of Short form-36 (SF-36) domains with Kellgren- Lawrence (KL) grades in cases

Table-6: Correlation of Short form-36 (SF-36) domains with age, ACV, WOMAC & VAS scores in cases

Table-7: Association of Short form-36 (SF-36) domains with gender in cases

Table-8: Multiple regression analysis

Table No. 1: General Characteristics

Characteristics	Case (n=90)	Control (n=40)	95% CI	p-value
Age (years)	51.40+12.65	50.19+9.64	-3.23 to 5.65	0.590
Gender **Male** **Female**	 28 (31.11%) 62 (68.88%)	 27 (64.51%) 13 (35.48%)	-	0.0090
Height (meter)	1.58+0.10	1.61+0.09	-0.01 to 0.07	0.164[a]
Weight (kg)	68.31+13.63	67.74+11.96	-6.32 to 5.18	0.845[a]
BMI	27.51+4.75	25.62+3.26	-4.07 to 0.29	0.089[a]
Duration of disease **6 months-1 year** **1-3 years** **3-6 years** **>6 years**	 19 (21.11%) 23 (25.55%) 27 (30) 21 (23.33%)	 -	 -	 -

BMI- Body Mass Index.

Values are represented as mean+ SD (standard deviation) and percentage (%). Means were compared using Student's unpaired t-test; * $p<0.05$ considered as statistically significant.

Table No. 2: Clinico-radiological profile of cases

Parameters	Mean + SD	95% CI
Clinical Parameters		
VAS	6.03+1.62	5.693 to 6.364
WOMAC pain	8.16+2.69	7.604 to 8.715
WOMAC stiffness	1.57+1.29	1.303 to 1.836
WOMAC physical function	24.47+9.16	22.577 to 26.362
Total WOMAC	34.20+11.66	31.791 to 36.609
Radiological Parameters		
KL grade (Frequency and %) **2** **3** **4**	 29 (32.22%) 37 (41.11%) 24 (26.66%)	-
Articular cartilage volume (cm^3)	4.331+1.478	4.025 to 4.636

Values are represented as mean+ SD (standard deviation) and percentage (%).WOMAC- Western Ontario and McMaster Universities Arthritis Index, VAS- Visual Analogue Scale, KL grade: Kellgren & Lawrence grade.

Table No. 3: Mean Scores and percentages of Short form-36 (SF-36) domains in cases and controls

SF-36 Components	Domains of SF-36	Maximum Score	Case (n=90)		Control (n=40)		p-value
			Mean Score+SD	Mean Percentage +SD	Mean Score+SD	Mean Percentage +SD	
Physical Components	Physical function	1000	483.56+216.43	48.91+20.85	837.50+62.92	83.75+6.29	**<0.001***
	Role limitations due to physical health	400	184.56+160.51	44.8+41.12	350.50+57.74	87.50+14.43	**<0.001***
	Pain	200	103.16+40.95	50.02+20.21	103.16+40.95	78.12+30.78	**<0.001***
	General health	500	229.67+100.77	44.66+19.41	229.67+100.77	83.75+6.29	**<0.001***
Mental Components	Role limitations due to emotional problems	300	250+93.92	82.76+31.59	300.00+0.00	100.00+0.00	0.140
	Energy/ fatigue	400	202.67+69.26	51.15+17.36	285.00+30.00	71.25+7.50	**<0.001***
	Emotional well being	500	337.02+81.36	68.63+15.63	410.00+38.30	82.00+7.65	**<0.001***
	Social functioning	200	144.62+34.30	72.84+16.01	168.75+12.50	84.37+6.25	**<0.001***

Values are represented as mean+ SD (standard deviation). Means were compared using Student's unpaired t-test; * $p<0.05$ considered as statistically significant.

Table No. 4: Comparison between components of SF-36 in cases and controls

SF-36 Components	Maximum Score	Cases (n=90)		Controls (n=40)		p-value
		Scores obtained	Percentage	Scores obtained	Percentage	
Physical Component	2100	1000.95+518.66	47.66+24.69	1520.83+262.38	72.42+57.79	<0.001
Mental Component	1400	934.31+278.84	66.73+19.91	1163.75+80.8	83.12+21.4	<0.001

Values are represented as mean+ SD (standard deviation). Means were compared using Student's unpaired t-test; * p<0.05 considered as statistically significant.

Table No. 5: Association of Short form-36 (SF-36) domains with Kellgren- Lawrence (KL) grades in cases

SF-36 domains	Kellgren- Lawrence grading			p-value
	KL grade 2 (N=29)	KL grade 3 (N=37)	KL grade 4 (N=24)	
Physical function	59.31+22.90	45.18+17.36	27.83+20.53	0.001*
Role limitations due to physical health	63.79+38.72	43.59+38.36	27.08+37.53	0.003*
Role limitations due to emotional problems	93.09+18.65	82.86+30.05	69.43+41.60	0.024*
Energy/Fatigue	60.27+17.73	48.54+15.36	41.87+15.59	<0.001*
Emotional well being	72.41+12.14	64.86+15.23	63.16+20.70	0.075
Social functioning	77.63+12.12	71.64+16.49	67.70+21.78	0.101
Pain	58.50+20.72	52.47+18.02	40.50+18.69	0.004*
General health	52.14+21.83	45.33+18.41	35.62+16.30	0.009*

Values are represented as mean+ SD (standard deviation). Means were compared using Analysis of Variance; * p<0.05 considered as statistically significant.

Table No. 6: Correlation of Short form-36 (SF-36) domains with age, ACV, WOMAC & VAS scores in cases

SF-36 domains	p-value (r)						
	Age	ACV	WOMAC pain	WOMAC stiffness	WOMAC phy fun	Total WOMAC	VAS
Physical function	0.021* (-0.260)	0.002* (0.315)	0.004* (0.303)	0.982 (0.002)	0.124 (-0.163)	0.063 (-0.197)	<0.001* (-0.626)
Role limitations due to physical health	0.033* (-0.242)	0.011* (0.265)	0.158 (-0.150)	0.542 (0.065)	0.107 (-0.171)	0.129 (-0.161)	<0.001* (-0.621)
Role limitations due to emotional problems	0.646 (-0.053)	0.107 (0.171)	0.035* (-0.222)	0.966 (-0.005)	0.524 (-0.068)	0.326 (-0.105)	0.001* (-0.359)
Energy/Fatigue	0.035* (-0.239)	0.001* (0.344)	0.011* (-0.266)	0.634 (-0.051)	0.014* (-0.259)	0.010* (-0.270)	<0.001* (-0.508)
Emotional well being	0.344 (-0.109)	0.056 (0.202)	0.006* (-0.285)	0.664 (0.046)	0.247 (-0.123)	0.138 (-0.158)	<0.001* (-0.417)
Social functioning	0.079 (-0.200)	0.100 (0.175)	0.019* (-0.247)	0.816 (-0.026)	0.070 (-0.192)	0.048* (-0.209)	<0.001* (-0.441)
Pain	0.131 (-0.162)	0.056 (0.202)	0.052 (-0.206)	0.904 (-0.013)	0.110 (-0.169)	0.087 (-0.181)	<0.001* (-0.696)
General health	0.092 (-0.181)	0.021* (0.243)	0.122 (-0.164)	0.772 (0.031)	0.120 (-0.165)	0.120 (-0.165)	<0.001* (-0.544)

ACV- Articular Cartilage Volume, WOMAC- Western Ontario and McMaster Universities Arthritis Index, VAS- Visual Analogue Scale.

Pearson's correlation coefficient (r) was used to correlate the variables, * p<0.05 considered as statistically significant.

Table No. 7: Association of Short form-36 (SF-36) domains with gender in cases

SF-36 domains	Gender		p-value
	Male (N=28)	Female (N=62)	
Physical function	54.05+22.54	43.43+19.73	0.020*
Role limitations due to physical health	62.16+41.92	33.03+34.15	<0.001*
Role limitations due to emotional problems	89.18+27.28	79.23+33.48	0.139
Energy/Fatigue	57.91+16.48	44.84+16.42	<0.001*
Emotional well being	73.62+12.70	62.22+17.38	0.001*
Social functioning	78.40+12.94	67.54+18.31	0.003*
Pain	59.08+17.38	44.16+20.46	<0.001*
General health	53.04+21.27	40.23+17.11	0.002*

Values are represented as mean+ SD (standard deviation). Means were compared using Student's unpaired t-test; * p<0.05 considered as statistically significant.

Table No. 8: Multivariable regression analysis

Variables	PF (R=0.693)	RLPH (R=0.679)	RLEP (R=0.581)	Energy (R=0.675)	EWB (R=0.629)	Pain (R=0.759)	SF (R=0.606)	GH (R=0.652)
Age	0.369	0.220	0.239	0.768	0.646	0.622	0.490	0.692
Height	0.973	0.964	0.991	0.841	0.483	0.827	0.652	0.038*
Weight	0.977	0.126	0.389	0.012*	0.018*	0.085	0.382	0.098
BMI	0.196	0.105	0.109	0.015*	0.001*	0.010*	0.017*	0.059*
KL grade	0.287	0.230	0.006*	0.039*	0.168	0.023*	0.609	0.127
WOMAC pain	0.368	0.593	0.009*	0.312	0.004*	0.164	0.166	0.994
WOMAC stiffness	0.942	0.549	0.565	0.498	0.305	0.837	0.736	0.638
WOMAC physical function	0.311	0.735	0.033*	0.393	0.073	0.232	0.946	0.485
VAS	<0.001*	<0.001*	0.046*	0.005*	0.080	<0.001*	0.039*	<0.001*
ACV	0.668	0.241	0.024*	0.243	0.191	0.023*	0.417	0.337

BMI- Body Mass Index, Kl grade- Kellgren& Lawrence Grade,WOMAC- Western Ontario and McMaster Universities Arthritis Index, VAS- Visual Analogue Scale, ACV- Articular Cartilage Volume, PF- Physical Function, RLPH- Role Limitations due to Physical Health, EWB- Emotional wellbeing, SF-Social Functioning, GH- General Health. * $p<0.05$ considered as statistically significant.

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