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Quality of life in subjects with osteoporosis evaluated with QPTQoL, a rehabilitation perspective.

Calidad de vida en sujetos con osteoporosis evaluada con QPTQoL, una perspectiva de rehabilitación.

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Abstract.
Osteoporosis is a chronic, degenerative, multifactorial metabolic skeletal disease characterized by deterioration of bone tissue. Rehabilitation by means of muscle strengthening, endurance, and balance training is recommended, and should be complemented with pharmacotherapy and adequate nutrition to improve patient mobility. The objective of the current study is to assess quality of life in patients diagnosed with osteoporosis using the Osteoporosis Targeted Quality of Life Questionnaire (OPTQoL). An observational, cross-sectional, ambispective, and analytical study was conducted at the Osteoporosis Clinic of the Central Military Hospital. A total of 100 patients diagnosed with osteoporosis were analyzed. Data collection was performed using OPTQoL, supplemented with a brief questionnaire to gather basic sociodemographic and clinical information. The comparison based on hip fracture showed differences in the physical function dimension ($p = 0.0076$). When analyzing the number of rehabilitation sessions, differences were found in the physical function dimension ($p = 0.0293$), in particular among those who received more than three sessions ($p = 0.0238$). Regarding fears, significant difference was found between patients with one session and those with more than three sessions ($p = 0.0491$). Significant differences were also observed among those who currently exercise ($p = 0.007$) and according to the number of times per week they exercise ($p = 0.0253$). Timely rehabilitation through exercise is a key therapeutic component for osteoporosis, along with pharmacological treatment and adequate nutrition, especially in patients with comorbidities.

Resumen.
La osteoporosis es una enfermedad esquelética metabólica crónica, degenerativa y multifactorial, caracterizada por el deterioro del tejido óseo. Se recomienda la rehabilitación mediante fortalecimiento muscular, resistencia y entrenamiento de equilibrio, que debe complementarse con farmacoterapia y una nutrición adecuada para mejorar la movilidad del paciente. El objetivo del presente estudio es evaluar la calidad de vida de pacientes diagnosticados con osteoporosis utilizando el Cuestionario de Calidad de Vida Dirigida a la Osteoporosis (OPTQoL). Se realizó un estudio observacional, transversal, ambispectivo y analítico en la Clínica de Osteoporosis del Hospital Militar Central. Se analizaron un total de 100 pacientes diagnosticados con osteoporosis. La recogida de datos se realizó utilizando OPTQoL, complementada con un breve cuestionario para recopilar información sociodemográfica y clínica básica. La comparación basada en fractura de cadera mostró diferencias en la dimensión de la función física ($p = 0,0076$). Al analizar el número de sesiones de rehabilitación, se encontraron diferencias en la dimensión de función física ($p = 0,0293$), en particular entre quienes recibieron más de tres sesiones ($p = 0,0238$). En cuanto a los temores, se observó una diferencia significativa entre los pacientes con una sola sesión y aquellos con más de tres sesiones ($p = 0,0491$). También se observaron diferencias significativas entre quienes hacen ejercicio actualmente ($p = 0,007$) y según el número de veces por semana que hacen ejercicio ($p = 0,0253$). La rehabilitación oportuna mediante ejercicio es un

Palabras clave:
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componente terapéutico clave para la osteoporosis, junto con el tratamiento farmacológico y una nutrición adecuada, especialmente en pacientes con comorbilidades.

Introduction.

Osteoporosis is present in 1 of 3 women and in 1 of every 5 men older than 50 years, nonetheless around 80% of patients remain undiagnosed and therefore inadequately treated[1]. It is the most prevalent rheumatic disease, and it affects more than 75 million people, it is related to 8.9 million fractures annually worldwide of which 4.5 occur in Latin America and Europe[2].

The assessment of quality of life in patients with osteoporosis through the application of the Osteoporosis Targeted Quality of Life Questionnaire (OPTQoL) survey is an essential tool from a rehabilitation perspective, as it enables measurement of the impact of this disease across various dimensions of the patient's physical, emotional, and functional well-being. Osteoporosis, characterized by reduced bone mass and fragility that may lead to fractures, significantly affects quality of life, particularly in aspects such as pain, mobility, and the ability to perform daily activities[3]. The OPTQoL survey, as a disease-specific instrument, is designed to capture these particularities, facilitating a comprehensive evaluation that is crucial for designing and adjusting personalized rehabilitation programs aimed at improving patients' well-being and autonomy[4].

From a rehabilitation standpoint, the measurement of quality of life helps to understand how osteoporosis limits the physical function, the development of daily activities, and the patient's socio-emotional component. This specific evaluation is fundamental for the monitoring of the effectivity of the therapies, to identify high impact areas and to orientate new strategies that contribute to a greater recovery and maintenance of the functional state. Plus, the employment of a validated and contextualized questionnaire as OPTQoL provides reliable and sensitive data to the clinical landscape, favoring better attention[5].

Therefore, the application of OPTQoL in osteoporosis patients from a rehabilitation perspective not only assesses physical symptoms but also addresses the psychosocial repercussions of the disease. This enables the implementation of multidisciplinary approaches integrating physical therapies, pain management, and psychological support, with a focus on promoting better quality of life and functionality in these patients. Thus, this tool is key to optimizing clinical outcomes and improving the overall well-being of individuals with osteoporosis[6]. This information is based on the characteristics and benefits of osteoporosis-specific quality-of-life tools, including various validated assessments and their relevance to clinical practice and rehabilitation[7].

Therefore, this tool is key to optimizing clinical outcomes and improving the overall well-being of people with osteoporosis.[6] This information is based on the characteristics and benefits of specific tools for osteoporosis quality of life, including various validated assessments and their relevance to clinical practice and rehabilitation.[7]Considering the above, we can ask: to what extent are the presence of hip fractures and adherence to rehabilitation sessions associated with the quality of life dimensions assessed by the OPTQoL in Mexican patients, through the application of the OPTQoL survey? Based on this question, we expect that the results of patients with hip fractures will show a lower HRQoL than those without fractures, and that there is a positive association between the number of rehabilitation sessions and the domains of physical function and fear reduction.

The objective of the study was to evaluate whether there is an association between the presence of hip fractures and adherence to rehabilitation programs with health-related quality of life (HRQoL) in patients with osteoporosis at a tertiary care hospital.

Methodology.

Recruitment.

The recruitment for the present study was performed in the Hospital Central Militar, Rehabilitation Service, Osteoporosis Clinic. Patients were recruited

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in a non-randomized strategy. The present study was designed as observational as no clinical intervention was assigned by the researchers, cross-sectional because quality of life was assessed at a single point in time during the patients' visit and ambispective as it collected current OPTQoL data while retrieving historical clinical records (e.g., fracture history) from hospital databases. Finally, it is analytical because it seeks to establish statistical associations between clinical variables and quality of life domains.

Although the OPTQoL was originally designed to analyze independent domains, a Composite Quality of Life Score was calculated for the purposes of this study. Following the methodology suggested by previous studies on analogous HRQoL instruments, the scores for each dimension were normalized to obtain a weighted average. This global measure allows for an exploratory interpretation of the patient's overall condition, although the main analysis focuses on the dimensions of Physical Function, Adaptations, and Fears independently, respecting the original psychometric properties of the questionnaire[10]. This study by Ariza-Ariza (2004) focuses on the cross-cultural adaptation and validation of the Spanish version of the Ankylosing Spondylitis Quality of Life Questionnaire (ASQoL). The study reported high internal consistency (Cronbach's α), indicating that the questionnaire items are strongly related and homogeneously measure the same construct. The process of cross-cultural adaptation ensured that the language and concepts were culturally appropriate, guaranteeing their applicability and equivalence with the original version, allowing their reliable use in Spain and, by extension, in Spanish-speaking contexts[10].

The sessions followed a standard protocol from the Central Military Hospital: isometric and dynamic strengthening exercises, balance exercises (modified Tai Chi), and spinal hygiene education, with each session lasting 45 minutes.

The sociodemographic questionnaire included variables such as marital status, educational level, and occupation. Additional clinical variables, such as education (receiving educational brochures), current exercise (regular physical activity in the last 3 months), and frequency, were collected using dichotomous and multiple-choice questions designed by the rehabilitation service for clinical triage purposes.

Data collection.

Information was collected using the Osteoporosis-Directed Quality of Life Questionnaire (OPTQoL), supplemented by a brief questionnaire to gather basic sociodemographic and clinical data. The OPTQoL assesses quality of life in three main domains: physical function, adaptations, and fears. Although this questionnaire does not incorporate a standardized overall score, the present study employed a calculation procedure that consists of dividing the total points obtained in each section by the corresponding number of items. The results from the three domains were summed to obtain the total score, taking into account two variables: Clinical variables: History of diabetes, hypertension, and cancer, as well as the use of specific medications (Denosumab, Vitamin D, etc.). Lifestyle variables: "Current exercise" (defined as >150 minutes of physical activity per week), "weekly sessions," "session duration," and the variable "education" (referring to whether the patient received the hospital's health education program). Based on this score, three levels of health-related quality of life (HRQ) impairment were established: mild, moderate, and severe disability.

This study was approved by the Ethics and Research Committee of the Central Military Hospital under registration number 032/2025 and followed the guidelines established in the Declaration of Helsinki. All subjects participated voluntarily, signed an informed consent form, and were informed about the objectives and follow-up period of the intervention. Furthermore, subjects could withdraw from the study at any time.

The data obtained were compiled in a structured Microsoft Excel database, where sociodemographic and clinical characteristics, as well as responses to

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each questionnaire item, were recorded individually. To ensure uniformity and traceability, responses were numerically coded, allowing for accurate data interpretation. Subsequently, the variables were organized into four dimensions: physical function, adaptations, fears, and total score, facilitating both intergroup comparisons and the application of statistical analysis.

Statistical Analysis

The analysis was performed using descriptive and inferential methods. Frequencies, measures of central tendency, and dispersion were calculated based on the nature of the variables.

The normality of the variables was verified using the Kolmogorov-Smirnov test. Because the OPTQoL dimensions did not show a normal distribution ($p < 0.05$), non-parametric statistics were chosen. Effect size was calculated using Rosenthal's r for Mann-Whitney U comparisons and H for Kruskal-Wallis. Given that $n = 100$, a post-hoc power analysis was performed. For the difference detected in physical function between groups with and without fracture, a power of $1 - \beta = 0.78$ was obtained (considering a medium effect size). To correct for Type I error due to multiple comparisons, the Bonferroni correction was applied, adjusting the significance level for the post-hoc tests. A p-value < 0.05 was considered significant, and $p < 0.01$ was considered highly significant.

Results.

The study population consisted of 100 subjects diagnosed with osteoporosis. The distribution by gender, along with other clinical and demographic data, is presented in Table 1.

Subgroups were formed in order to evaluate HRQoL dimensions. When comparing subjects with and without hip fracture, significant differences were shown ($p = 0.0076$) in physical function in those without fracture, in adaptation ($p = 0.0649$) and fears ($p = 0.1159$) dimensions there were no differences. However, there was significant difference in the total score ($p = 0.0255$) which reflects a greater impact

Variable	n (%)	Mean ± SD / Median (RIQ)
Age (years)		**67.4 ± 9.2**
Sex		
Female	96 (96%)	
Male	4 (4%)	
Comorbidities		
Diabetes Mellitus	35 (35%)	
High blood pressure	52 (52%)	
Cancer (Antecedent)	28 (28%)	
Fracture History		
Hip Fracture (Total)	15 (15%)	
Hip fracture (last year)	12 (12%)	
Other fractures	16 (16%)	
Pharmacological treatment		
Denosumab	96 (96%)	
Vitamin D/Calcium	44 (44%)	
Rehabilitation		
Sessions received		**4.0 (1.0 - 6.0)**

Table 1

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Variable	Category	n (%)	Dimension OPTQoL	Statistic Test Value	P value
Hip fracture	Yes (n=15) vs. No (n=85)	15% vs. 85%	Physical function	U = 324.5	0.0076 **
			Adaptation	U = 512.0	0.0649
			Fears	U = 560.5	0.1159
			Total score	U = 388.0	0.0255*

Table 2. Comparison between hip fracture.

over the global HRQoL in subjects with hip fractures (Table 2).

P-values and U statistics were calculated using the Mann-Whitney U test to compare two independent groups (with vs. without fracture). A p-value ≥ 0.05 was considered statistically significant.

The comparison based on hip fracture showed significant differences in the physical function dimension (U = 324.5, p = 0.0076), confirming a greater functional impact in this subgroup.

In the comparison between rehabilitation sessions, three subgroups were formed: 1 session, 2 to 3 sessions, 3 or more sessions. Statistical analysis showed significant differences in the physical dimension (p = 0.0293), post-hoc analysis showed that this difference was between 1 session and 3 or more sessions (p = 0.0238), evidencing better results of the rehabilitation program in the ladder. Regarding fears, significant difference was found between 1 session and 3 or more sessions (p = 0.0491). In the total score there were also significant differences between these two groups (p = 0.0208), however this was not the case in the adaptation dimension (p = 0.0698). The variables "teachings", "perform exercise", "times a week" and "session duration" did not showed significant differences between dimensions of OPTQoL. In a parallel way, the Chi squared analysis suggested that performing exercise and with greater frequency is associated with a greater probability of reporting an improvement in HRQoL (Table 3).

Regarding the individual items of the OPTQoL questionnaire, the Physical Function domain revealed that the most frequent limitations were related to lifting heavy objects (reported by 72% of the sample) and climbing stairs (65%). In the Adaptations domain, 58% of participants reported having modified their home environment or clothing to prevent falls. Notably, the Fears domain showed the highest individual item scores, with 'fear of falling' being the most prevalent concern (68% of patients), followed by 'fear of becoming dependent on others' (54%). These descriptive results highlight that

Variable	Subgroups (n)	Dimension OPTQoL	Statistic Test Value	P value
Sessions of Rehabilitation	1 sess (12); 2-3 sess (31); >3 sess (57)	Physical function	H= 7.15 (df=2)	0.0293*
		Fears	H = 6.02 (df=2)	0.0491*
		Total score	H = 7.74 (df=2)	0.0208*
		Adaptation	H = 5.33 (df=2)	0.0698
Performs Exercise	Yes (45) / No (55)	Improvement HRQoL	chi2 = 8.93 (df=1)	0.007**
Frequency of Exercise	1-2 (20), 3-4 (15), >4 (10)	Improvement HRQoL	chi2 = 11.11 (df=4)	0.0253*

Table 3. Comparison between rehabilitation sessions.: The Kruskal-Wallis test (H) was used to compare the three groups of sessions. The chi-square test was used for categorical exercise variables. * p ≥ 0.05; ** p ≥ 0.01.

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while physical limitations are significant, the psychological burden—specifically the fear of injury—is a predominant factor in the perceived quality of life of this cohort.

Discussion

The results of this study reflect a typical profile of patients with osteoporosis: postmenopausal women (n=96; 96%) aged 60-79 years (n=61; 61%), with comorbidities such as hypertension (n=, 52; 52%) and diabetes (n=35; 35%), and predominant treatment with denosumab (n= 96; 96%). This distribution aligns with the epidemiology of the disease, where fractures (n=15; 15% hip, n=16; 16% other) represent a key outcome that worsens the clinical impact. The high adherence to rehabilitation 3 sessions or more in 57 subjects (57%) suggests patient motivation to improve functionality, although 12% (n=12) attended only once, possibly due to access barriers[8,9].

The high prevalence of comorbidities in our sample is noteworthy, particularly hypertension (52%) and diabetes (35%). Previous studies suggest that the coexistence of type 2 diabetes mellitus and osteoporosis accelerates the deterioration of bone microarchitecture. In our study, although the main focus was rehabilitation, the presence of these metabolic pathologies underscores the need for a multidisciplinary approach, as comorbidities can act as confounding variables that limit the functional gains obtained through exercise[14].

Recent research (2024-2026) has solidified the concept of diabetic osteoporosis as a chronic complication, where diabetes and obesity act synergistically to increase bone fragility and accelerate the decline in physical function. The risk of fracture is heightened not only by reduced bone density but also by impaired bone quality, which significantly worsens patients' quality of life and mobility [14,15].

Regarding the observed differences, patients with hip fracture showed worse physical function and total OPTQoL score, with no differences in adaptations or fears, confirming the instrument's sensitivity in detecting physical deterioration post-fracture. This aligns with OPTQoL validation studies, where vertebral fractures increased scores (worse quality of life) across all domains, highlighting fractures as a predictor of disability. The absence of differences in fears could be due to the fractures having occurred more than one year prior, allowing for emotional coping[10,11].

The benefits of rehabilitation are reflected in a higher number of sessions (3 or more vs. 1), which significantly improved physical function, fears, and total score, with no effect on adaptations. This finding supports prolonged rehabilitation interventions, which counteract functional limitations and anxieties associated with osteoporosis, similar to evidence of post-fracture recovery at 4 months. The chi-square test trend reinforces an improvement trend in patients with greater adherence, suggesting minimum thresholds for clinical benefits[12].

Current exercise showed a significant association with health-related quality of life (HRQoL), which is consistent with the reported improvement in the total scale score, although the impact on specific dimensions such as Adaptations was less pronounced. Variables such as patient education or session duration showed no effects, indicating that practical adherence surpasses formal education in this context. These results underscore the need to promote regular exercise within comprehensive programs[4,13]. The results of the present study are coherent with the recent evidence that backs that the multicomponent exercise, well-dosed and progressive, is an effective therapy that improves physical function and HRQoL in people at risk of osteoporosis and even patients[16]. In similar populations, supervised programs of up to 12 weeks have shown significant improvements in strength and equilibrium, along with a decrease in the fear of falling, even though HRQoL does not always improves in this dominion, the functional outcomes improve[17].

The clinical implications of these findings validate OPTQoL as a discriminative tool in rehabilitation, prioritizing patients with fractures and intensive

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sessions to optimize quality of life. Future longitudinal studies could explore causality and subgroups (e.g., patients with specific comorbidities), strengthening the basis for personalized therapeutic guidelines[18].

Although the present study was based on OPTQoL, it is worth mentioning the use of other very useful tests such as the FRAX® model, which is a fundamental tool in the discussion of osteoporosis studies. FRAX allows for the contextualization of fracture risk in the analyzed patients compared to international standards, converting local epidemiological data into 10-year absolute probabilities. It also allows for the comparison of whether the studied cohort has a higher, lower, or equal risk to reference populations (generally European or North American). However, it should be noted that conventional FRAX may underestimate risk in patients with recent or multiple fractures, frequent falls, or type 2 diabetes[19,20]. A comparative study of both tests would be worthwhile in future research.

In summary, the OPTQoL assessment of quality of life in 100 subjects with osteoporosis showed a significant association between hip fractures and a significantly worsened physical function and total score, while more than three rehabilitation sessions improved these domains compared to a single session. Regular exercise was associated with a perceived improvement in QFC, highlighting prolonged interventions and physical activity as key strategies within rehabilitation[8,12].

It is important to emphasize that, due to the cross-sectional nature of this study, the results should be interpreted as clinical associations and not as causal relationships. While patients with more than three rehabilitation sessions showed better scores on the physical function dimension, it is not possible to determine whether the rehabilitation caused the improvement or whether patients with better baseline functional status exhibited greater adherence to treatment. Future prospective cohort studies are needed to validate the therapeutic efficacy of the program.

Limitations

This study has certain limitations that should be acknowledged. Primarily, the OPTQoL instrument has not yet been formally validated for the Mexican population, although its high reproducibility in Spanish-speaking cohorts supports its current application. Furthermore, the cross-sectional nature of the data limits the ability to establish causal relationships between the intensity of rehabilitation and long-term improvements in quality of life. Despite these limitations, the findings provide a solid preliminary framework for the functional assessment of osteoporotic patients in a clinical setting.

It is important to note that, although the OPTQoL proved useful in this context, its cross-sectional design does not allow for establishing a causal (dose-response) relationship between exercise and HRQoL. The results suggest an association, but selection bias may exist, with patients having better baseline health being more likely to adhere to rehabilitation programs.

CONCLUSIONS

In conclusion, the assessment of quality of life using the OPTQoL questionnaire provides critical information about the functional and emotional burden of osteoporosis. Our findings demonstrate that hip fractures drastically reduce physical well-being, while consistent adherence to rehabilitation programs—especially those exceeding three sessions—acts as an important factor in improving patient outcomes. Furthermore, the association between regular physical exercise and improved quality of life underscores the need to go beyond pharmacological treatment. These results suggest that clinical management should integrate intensive supervised exercise programs tailored to the patient's specific physical limitations to achieve significant improvements in their daily independence and overall health perception.

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