Factors related to quality of life in non-Hispanic white adults with and without type 2 diabetes

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The objective of this study was to compare quality of life (QoL) and factors which relate to QoL in non-Hispanic white adults with and without type II diabetes (DM). This cross sectional study included thirty-eight participants: 19 adults aged 18 - 75 with type II diabetes and 19 healthy control adults without diabetes. Socio-demographic information was collected on age, ethnicity, marital status, education level, employment, and current health. Participants completed self-report questionnaires on activity limitations, community integration, emotional/social function, and global and specific quality of life. Performance-based tests were administered to measure grip and pinch strength, dexterity, and upper and lower extremity joint motion. t-tests were done to compare the participants with and without DM on the demographic variables, self-report questionnaires and performance based tests. Spearman rho correlation coefficients were done to determine relationships between QoL and other variables. The DM group had significantly lower levels of current health than the healthy control group, but there were no significant group differences between other demographic variables. The DM group had significantly lower present and past QoL and specific QoL than healthy controls. The DM group also had more pain and joint limitations, decreased dexterity, poorer emotional/social function, more activity limitations and less community integration than healthy controls. In the DM group, age, pain, joint motion, emotional/social, functional disability, and community integration correlated with specific QoL. In contrast, in the HC group, pain, emotional/social, health and functional disability correlated with the specific QoL.

Keywords: Diabetes; Quality of life; Activity limitations; Participation


Introduction

Type 2 Diabetes Mellitus (DM) is a condition of high blood glucose because insulin production is inadequate, or the body does not properly use insulin [1]. Because of the increased prevalence of Diabetes Mellitus (DM) as well as increased life expectancy, people with DM must manage both short-term and long-term complications which can impact quality of life. A number of studies have examined QoL or perceived physical, emotional and social wellbeing [2]. The majority of studies looked at the relationships between disease severity, sociodemographic factors, and depression, and QoL. These studies report that depression, medical complications, number of comorbid conditions, and poor glycemic control have negative effects on QoL [3-7]. Interestingly, a longitudinal study found that QoL was higher for persons with Type II diabetes with advancing age [8]. People with DM also have limitations in mobility, hand function, and performance of daily tasks, which have also been reported to relate to QoL [9-14]. Mobility and the ability...
to perform daily tasks are crucial to living independently. However, it is not clear how these factors impact QoL in persons with DM. Therefore, the purpose of this study was to compare quality of life (QoL) and factors which relate to QoL in non-Hispanic white adults with and without type II diabetes (DM).

Patients and Methods

Participants

Thirty-eight white non-Hispanic adults participated in this study: 19 persons with Type 2 DM (DM group) and 19 healthy controls (HC group). Inclusion criteria for the DM group were disease duration of at least 5 years with no other chronic health conditions, and age 18-75 years. Inclusion criteria for the healthy controls were age 18-75 years and no self-reported chronic conditions. Participants were recruited by posted advertisements in clinics. This study was approved by the University Research Review Committee.

Instruments

QoL was measured using both a global QoL and component-specific QoL instrument. The other instruments covered the categories of the International Classification of Functioning, Disability, and Health (ICF): Body Functions and Activities and Participation [15]. Body Functions, instruments assessed pain, hand function, upper and lower extremity joint motion, and emotional and social function. The Activities and Participation instruments assessed daily living skills and community participation. Socio-demographic data was also obtained regarding age, gender, marital status, educational level, employment status, occupational status, disease condition (DM or healthy control) and current health.

Measures of QoL

Global QoL was measured with Cantril’s Self-Anchoring Scale [16]. This instrument has a picture of a 10-rung ladder. The top rung, 10, represents the best possible life, while the bottom rung, 0, the worst possible life. Participants rated their QoL on the ladder for three points in time: the present, 5 years ago, and 5 years in the future.

Component-specific QoL was measured with the Dartmouth Primary Care Cooperative pictorial chart (COOP) which evaluates difficulty with daily activity, health, social activity, physical fitness, pain, and feelings [17]. Participants rate difficulty level for each item for the past two weeks on a 5-point scale ranging from 1 (great difficulty) to 5 (no difficulty). Higher scores indicate better QoL.

Measures of Body Functions-Body Structures

Pain was measured using pain chart from the COOP [17]. Pain level is rated from 1 (severe pain) to 5 (no pain).

Hand function was assessed with the Arthritis Hand Function Test (AHFT), a performance based that that measured hand strength, applied strength, dexterity and applied dexterity [18-20]. Grip and two-point and three-point pinch strength (hand strength) were measured with an adapted sphygmomanometer and a pinch meter, respectively. The means of three trials for grip and pinch strength were recorded. The mean scores for grip, two-point pinch, and three-point pinch strength for each hand were added to make a strength score for each hand. The items for applied strength were pouring water from a pitcher and lifting a tray of cans. Dexterity was assessed with the nine-hole pegboard which measures the time taken to place and remove nine pegs from the pegboard. Applied dexterity was measured with five timed bilateral activities: fastening and unfastening buttons, lacing and tying a shoe, fastening and unfastening safety pins, cutting putty with a knife and fork, and manipulating coins into a slot. The scores from each of the applied dexterity items were added to create a total applied dexterity score.

Upper and lower extremity joint motion was measured with the Keital Functional Test (KFT) [21, 22]. The KFT consists of 24 items. Each item has specific scoring criteria. A lower score represents better joint mobility.

Emotional and social functions were measured using the feelings and social activity items from the COOP Emotional charts [17]. Participants rate feelings from 1 (bothered a lot by feeling nervous, sad or easily angered) to 5 (not at all bothered by feeling nervous, sad or easily angered) while perceptions of social function were rated from 1 (no participation in social activities) to 5 (much participation in social activities). The scores were summed to form an emotional and social function score.

Activity limitation in daily tasks was measured by the Health Assessment Questionnaire (HAQ) which assesses difficulty in 8 categories: dressing and grooming, arising, eating, walking, hygiene, reach, grip, and activities [23]. Questions in each category are scored from 0 (without difficulty) to 3 (unable to do). The highest score for any question in a category determines the score for that category. An activity limitation score was calculated by adding all the category scores and dividing by the number of categories which yields a score from 0 (no limitations) to 3 (severe limitations) [23].
Table 1. Demographic Characteristics of Participants by Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>DM (N = 19)</th>
<th>HC (N = 19)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age ± SD (range)</td>
<td>57.4 ± 11.2 (39-74)</td>
<td>51.1 ± 9.2 (34-74)</td>
<td>ns</td>
</tr>
<tr>
<td>Mean Disease Duration ± SD (range)</td>
<td>8.5 ± 8.1 (.50-30)</td>
<td>NA NA</td>
<td></td>
</tr>
<tr>
<td>Percent Education &gt; 12 years</td>
<td>68.4% 70.6%</td>
<td>ns ns</td>
<td></td>
</tr>
<tr>
<td>Percent Married</td>
<td>58% 41%</td>
<td>ns ns</td>
<td></td>
</tr>
<tr>
<td>Percent Female</td>
<td>47.4% 68.4%</td>
<td>ns ns</td>
<td></td>
</tr>
<tr>
<td>Percent Work Full-time</td>
<td>44.4% 65%</td>
<td>ns ns</td>
<td></td>
</tr>
<tr>
<td>Mean Current Health ± SD (range)</td>
<td>3.1±1.0 (1-5)</td>
<td>4.4±0.60 (3-5)</td>
<td>.001</td>
</tr>
</tbody>
</table>

Note. SD = standard deviation; DM = diabetes mellitus; HC = healthy control; ns = not significant; NA = not applicable

Community participation was measured with the Community Integration Questionnaire (CIQ) [24]. The CIQ has three subscales: Home Integration, Social Integration, and Productivity. Items are scored from 0 (some else does activity or never do activity) to 2 (person does activity or activity done 5 or more times per week). The total score is the summation of all items and can range from 0 to 29. The higher the score, the greater the integration.

Procedure

After written informed consent was obtained, the instruments described above were administered. Data collection took approximately one hour and participants were compensated for their time.

Data Analysis

The data was analyzed using Statistical Package for the Social Sciences (SPSS) software and means, standard deviations (SD), and ranges were calculated for all variables. Chi square tests were used to compare the groups on the categorical variables. t-test analyses were performed to compare the DM and HC groups on all continuous variables. Spearman correlation coefficients were calculated to determine the relationships between QoL and age, disease duration, current health, pain, emotional and social function, KFT, HAQ, and CIQ for both the DM and HC groups.

Results

Demographic variables of the participants by group are shown in Table 1. There were no significant differences between the two groups for any of these variables except for current health. The DM group reported significantly lower current health than the HC group.

As shown in Table 2, the DM group had significantly lower scores for present and past QoL and the COOP compared to the HC group. Table 2 also shows the DM group had significantly more activity limitations (HAQ) and less participation (CIQ) than the HC group.

For the body structure/function variables (Table 3), significant differences were found between the groups for all variables except right and left hand strength and applied strength (lifting tins and pouring water). Both groups scored the maximum scores for the applied strength tasks. The DM group had more pain, more joint limitations, required more time on the pegboard and applied dexterity tasks, and showed lower emotional/social scores.

Table 4 shows the Spearman rho correlation coefficients between QoL, body function, and activity and participation variables in each group. In the DM group, significant correlations were found between age, pain, lower extremity (LE) KFT, total KFT, emotional/social, HAQ, CIQ, and the total COOP. However, none of the variables correlated with the global QoL measures except disease duration which correlated with future QoL.

Table 2. Mean Scores for QoL and Activities and Participation Variables by Participant Group

<table>
<thead>
<tr>
<th>Variables</th>
<th>DM (n=19) Mean ± SD (range)</th>
<th>HC (n=19) Mean ± SD (range)</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Global QoL (0-10)</td>
<td>7.5 ± 1.2 (5-9)</td>
<td>8.6 ± 0.9 (7-10)</td>
<td>-3.3</td>
<td>.002</td>
</tr>
<tr>
<td>Past Global QoL (0-10)</td>
<td>6.4 ± 2.5 (2-10)</td>
<td>8.1 ± 1.4 (6-10)</td>
<td>-2.5</td>
<td>.017</td>
</tr>
<tr>
<td>Future Global QoL (0-10)</td>
<td>8.5 ± 1.8 (5-10)</td>
<td>9.0 ± 0.9 (8-10)</td>
<td>-1.0</td>
<td>ns</td>
</tr>
<tr>
<td>COOP (0-30)</td>
<td>20.3 ± 4.5 (8-27)</td>
<td>25.7±2.8 (21-30)</td>
<td>-4.4</td>
<td>.001</td>
</tr>
<tr>
<td>HAQ (0-3)</td>
<td>0.7 ± 0.7 (0-1.9)</td>
<td>0.1 ± 0.3 (0-1)</td>
<td>3.5</td>
<td>.001</td>
</tr>
<tr>
<td>CIQ (0-29)</td>
<td>20.1 ± 5.1 (7-26)</td>
<td>24.3 ± 4.3 (12-28)</td>
<td>-2.7</td>
<td>.01</td>
</tr>
</tbody>
</table>

Note. SD = standard deviation; DM = diabetes mellitus; HC = healthy control; ns = not significant; QoL = quality of life; HAQ = Health Assessment Questionnaire; CIQ = Community Integration Questionnaire; COOP = Dartmouth Primary Care Cooperative Information Project
In the HC group, pain, emotional/social, health, and HAQ correlated significantly with the COOP total. Only education, pain, and HAQ significantly correlated with present QoL. Pain, right-hand strength, left-hand pegboard, and CIQ all

Table 3. Mean Scores for Body Functions and Body Structures Variables by Participant Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>DM (N=19) Mean ± SD (range)</th>
<th>HC (N=19) Mean ± SD (range)</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain (0-5)</td>
<td>2.8 ± 1.3 (1-5)</td>
<td>3.9 ± 0.9 (2-5)</td>
<td>-3.3</td>
<td>.002</td>
</tr>
<tr>
<td>UE KFT (0-52)</td>
<td>13.7 ± 11.7 (4-44)</td>
<td>6.4 ± 4.2 (4-21)</td>
<td>2.6</td>
<td>.017</td>
</tr>
<tr>
<td>LE KFT (0-40)</td>
<td>6.3 ± 8.9 (0-38)</td>
<td>1.7 ± 2.1 (0-9)</td>
<td>2.2</td>
<td>.042</td>
</tr>
<tr>
<td>Total KFT (0-92)</td>
<td>20.1 ± 19.3 (6-82)</td>
<td>8.1 ± 5.7 (4-30)</td>
<td>2.6</td>
<td>.017</td>
</tr>
<tr>
<td>Hand Strength R (lb)</td>
<td>100 ± 17.6 (64-133)</td>
<td>99.3 ± 15.1 (65-119)</td>
<td>.13</td>
<td>ns</td>
</tr>
<tr>
<td>Hand Strength L (lb)</td>
<td>94.6 ± 20 (53-124)</td>
<td>97.4 ± 17.2 (57-124)</td>
<td>-.45</td>
<td>ns</td>
</tr>
<tr>
<td>Pegboard R (sec)</td>
<td>29.1 ± 12.4 (17.4-51)</td>
<td>18 ± 2.5 (13-22)</td>
<td>3.8</td>
<td>.001</td>
</tr>
<tr>
<td>Pegboard L (sec)</td>
<td>31.5 ± 14.1 (18-62)</td>
<td>19.1 ± 2.9 (14-24)</td>
<td>3.8</td>
<td>.001</td>
</tr>
<tr>
<td>Applied Dexterity (sec)</td>
<td>152.5 ± 57.5 (92-272)</td>
<td>95.5 ± 9.4 (75.5-113)</td>
<td>4.3</td>
<td>.000</td>
</tr>
<tr>
<td>Tins (# cans lifted)</td>
<td>12</td>
<td>12</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Water (# ml water poured)</td>
<td>2000</td>
<td>2000</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Emotional/Social (0-10)</td>
<td>7.5 ± 1.9 (2-10)</td>
<td>8.6 ± 1.2 (6-10)</td>
<td>-2.2</td>
<td>.037</td>
</tr>
</tbody>
</table>

Note. DM = diabetes mellitus; HC = healthy control; KFT = Keital Functional Test; ns = not significant; LE = lower extremity; UE = upper extremity; NA = not applicable.

Table 4. Significant Spearman rho Correlations by Participant Group

<table>
<thead>
<tr>
<th>DM Group</th>
<th>QoL Present</th>
<th>QoL Past</th>
<th>QoL Future</th>
<th>COOP Total</th>
<th>QoL Present</th>
<th>QoL Past</th>
<th>QoL Future</th>
<th>COOP Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>-.481**</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
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<tr>
<td>Disease duration</td>
<td>ns</td>
<td>ns</td>
<td>.67**</td>
<td>ns</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Education</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>.59**</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Pain</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>.697**</td>
<td>.502*</td>
<td>.509*</td>
<td>ns</td>
<td>.748**</td>
</tr>
<tr>
<td>LE KFT</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>-.778**</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Total KFT</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>-.561*</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Emotional/Social</td>
<td>ns</td>
<td>ns</td>
<td>.736**</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>.788**</td>
</tr>
<tr>
<td>Strength R</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>.461*</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Strength L</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Pegboard L</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
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<tr>
<td>Current Health</td>
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<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>HAQ</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>-.805**</td>
<td>-.533*</td>
<td>-.567**</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>CIQ</td>
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<td>ns</td>
<td>.752**</td>
<td>ns</td>
<td>-.554**</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>

Note. HAQ = Health Assessment Questionnaire; CIQ = Community Integration Questionnaire; QoL = Quality of Life; COOP = Dartmouth Primary Care Cooperative Information Project; KFT = Keital Functional Test; ns = not significant *p < .05 **p < .01
Discussion

This study compared QoL and factors related to QoL in persons with and without DM in a non-Hispanic White population. There were several major findings of this study. First, the DM group reported lower perceptions of both present and past global (Cantril’s Ladder) and specific QoL (COOP) than did the healthy control group.

These findings support previous research that overall QoL for those with DM is decreased compared to people without DM [3, 25-27] and people with other chronic conditions [28]. Contrary to our findings, Arnold et al. [29] found that no significant differences in global QoL (as measured by Cantril’s ladder) between healthy subjects and persons with DM. Poole et al. [26, 27] showed that while specific QoL was decreased in persons with DM compared to healthy controls, global QoL was similar.

Second, the results also showed that the DM group had significantly more impairments on the body function measures, except hand strength and applied hand strength. In fact, hand strength and applied hand strength were the only body function variables that were not different between the two groups. This finding is surprising, as previous studies have shown that people with DM have decreased hand strength compared to healthy control groups [30-32]. One possible explanation for our findings may be due to the higher percentage of women in our HC group as compared to men in the DM group. In general, it is thought that men typically have greater overall strength than do women, and this supposition may have contributed to the negligible differences between the two groups. However, our findings regarding increased impairments in pain, joint motion, and dexterity in the DM group compared to healthy controls are similar to others [13, 14, 30, 32].

Third, our study found that activity limitations and participation were all lower for the DM group compared to the HC group which is not surprising. Others have reported limitations in activities in DM [9, 12, 33]. Previous research on QoL in Native Americans with DM also found decreases in activity and participation compared to those without DM [26, 27, 34]. The increased pain, limited joint motion, and hand impairments in the DM group may have contributed to the decreased activity limitations and participation as has been found in another studies [32]. It is interesting that differences were found in activity limitations and participation in this relatively young group of non-Hispanic white adults with DM as previous research suggests that older non-Hispanic white women with DM may be more at risk for activity limitation as much as non-Hispanic black women [33].

Fourth, similarities and differences in factors related to QoL were found in the two groups. Pain, HAQ, and emotional/social variables related to specific QoL (COOP) in the both DM and HC groups which was similar to findings by Poole et al. [27]. However, there were no factors common to both groups that correlated with global QoL. In fact, in the DM group, only one factor, disease duration, related to any of the global QoL measures. Other studies have found more factors related to specific QoL than global QoL [27] perhaps because specific measures require people to reflect on individual aspects of QoL rather than a more general overall perception of QoL.

In contrast, for the healthy control group, several factors related to past and present global QoL but not future QoL. In addition, pain and the HAQ were related to both global and specific QoL. However, our study supports previous findings by others [26, 27], which also found pain was related to present QoL, and current health status was related to specific QoL.

Limitations

There are several limitations to this study. First, the small sample is from a narrow geographic location and thus, our sample may not be representative of all non-Hispanic White adults with DM. Second, the participants were non-Hispanic white adults. The impact of DM on QoL and other variables may be different in other ethnic groups. However, the level of QoL in our participants with DM was similar to the level of QoL in similar studies on Native Americans with DM [26, 27]. Furthermore, in a study comparing Native American and non-Hispanic White adults with and without rheumatoid arthritis, Poole, Chiappsi, Schukar-Cordova and Sibbitt [35] found that differences in QoL were related to having arthritis and not related to ethnicity.

Third, although we collected data on the psychosocial status of our participants, a formal measure of depression was not included. Previous research has shown that depression can effect perceived QoL and that people with DM are twice as likely to develop depressive symptoms [36]. Therefore, future studies should examine depression by using specific measures of depression and how depression relates to QoL in individuals with DM.

Conclusion

In conclusion, this study describes differences in QoL, body function and activity limitation and participation in
Understanding the factors that relate to QoL suggest that several of the categories on the ICF such as joint motion, pain, activity limitations and participation need to be assessed in persons with DM. Interventions for these may contribute to improved QoL.

Acknowledgements

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Conflict of Interest

The authors declare they have no conflicting interests.

Authors’ contributions

JLP conceived the study, participated in the design of the study, performed the statistical analysis and wrote the manuscript. CSG and AS conducted interrater reliability, coordinated the study, recruited and tested participants, and wrote the manuscript. All authors read and approved the final manuscript.

References


