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Quality of life and physical fitness in an 85-year-old population

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ABSTRACT

Since little is known about the very elderly population aged 80 years and older, we evaluated the association of quality of life (QoL) in an 85-year-old population with physical fitness measurements assessed at age 80 and 85 years. Two hundred seven individuals (90 males, 117 females) aged 85 years underwent the Short Form-36 (SF-36) questionnaires for QoL assessment and physical fitness measurements (handgrip strength, leg-extensor strength, one-leg standing time, stepping rate of legs, walking speed). In 85-year-olds, significant associations were found, by multiple regression analysis or logistic regression analysis, with adjustment for various influencing factors in QoL assessed by SF-36 with physical fitness measurements examined at the age of 85 and 80 years. Physical scales and scores in SF-36, such as physical functioning (PF), limitation in role functioning for physical reasons (role physical; RP), bodily pain (BP), and the physical component score (PCS) tended to be more tightly associated with fitness measurements than mental scales and scores such as limitation in role functioning for emotional reasons (role emotional; RE), and emotional well-being (mental health; MH), and mental component score (MCS). Three scales the general health perceptions (GH), the vitality (VT), and the social functioning (SF) consisting of both physical and mental components were associated with fitness, the extent being intermediate between physical scales and mental scales. Of the several physical fitness measurements, leg-extensor strength and the walking speed of 85-year-olds, and the stepping rate of 80-year-olds were most closely associated with QoL. In a very elderly population of 85- and 80-year-olds, significant associations were found between QoL by SF-36 and physical fitness measurements, suggesting that increases in the levels of physical fitness, even in the very elderly, can contribute to improvements in QoL.

1. Introduction

Physical fitness status has been reported to be associated with QoL in general population samples (Laforge et al., 1999; Blacklock et al., 2007). There is a weak-to-moderate association between walking and GH, VT, and SF after controlling for key demographics (Blacklock et al., 2007). Exercise stage is associated with self-perceived QoL, in which PF, GH perceptions, and VT are most strongly related (Laforge et al., 1999). Physical fitness interventions have also improved QoL in patients with cancer following high-dose chemotherapy and autologous bone transplantation (Courneya et al., 2000), primary breast cancer (Kolden et al., 2002), cancer survivors (Courneya et al., 2003; Cheema and Gaul, 2006; Herrero et al., 2006a,b), coronary artery disease (Hung et al., 2004), peripheral arterial disease (Collins et al., 2005), and diastolic heart failure (Gary and Lee, 2007).

In an elderly population, physical fitness has similarly been found to be associated with QoL (Chang et al., 2001; Stewart et al., 2003; Uemura and Machida, 2003; Antunes et al., 2005; Elavsky et al., 2005). In 123 older Japanese people aged 74.3 years, a few satisfaction factors were found to be related to functional fitness tests of muscle strength, agility, coordination, balance, and flexibility (Chang et al., 2001). In another elderly Japanese population of mean age of 74 years (Uemura and Machida, 2003), significant associations were found between physical fitness and QoL assessed by the SF-36 method (Ware and

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Sherbourne, 1992; Hays et al., 1993). Higher aerobic fitness in older persons aged between 55 and 75 years is associated with more desirable outcomes by health-related QoL (HRQoL) assessed by SF-36, including BP, PF, VT and PCS (Stewart et al., 2003). Long-term effects of physical exercise trial on QoL in older adults aged 66.7 years are partly mediated by intermediate psychological outcomes (Elavsky et al., 2005). An aerobic exercise program at the intensity of ventilatory threshold 1 was found to improve QoL in seniors aged 60–75 years (Antunes et al., 2005). Home-based walking is effective in improving QoL among community residents aged 42–75 years (Okamoto et al., 2007). These findings suggest that physical fitness can be associated with QoL in an elderly population younger than 80 years. However, little is known regarding the relationships in a very elderly population aged 80 years or older. We, therefore, evaluated the association of QoL in an 85-year-old population with physical fitness measurements assessed at age 80 and 85 years.

2. Methods

Participants (207 subjects, 90 males, 117 females) residing in 1 of 9 districts (Bunzen City, Munakata City, Yukuhashi City, Tobata Ward of Kitakyushu City, Kanda Town, Katsuyama Town, Toyotsu Town, Tsuiki Town, or Shinyoshitomi Village) in Fukuoka Prefecture, Japan were born in 1917 and were 85 years old in 2002 when physical fitness measurements were made and QoL questionnaires were obtained. The study was approved by the Human Investigations Committee of Kyushu Dental College, and was conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki, as revised in 2002. Informed written consent was obtained from all participants according to the principles mentioned above.

The 85-year-old subjects completed five types of neuromuscular tests in 2002: two tests of muscle strength (handgrip, isometric leg-extensor), one test of balance (one-leg standing time), one test of neuromuscular endurance (stepping rate), and one test of walking (walking speed). The numbers of subjects participating in the tests were 198, 159, 169, 168, and 151, respectively. The grip strength of each hand was measured by a Smedley hand dynamometer (DM-100S; Yagami, Nagoya, Japan). The average value of two trials for each hand was taken as the score for the test. Leg-extensor strength was measured by a portable chair incorporating a strain gauge connected to a load cell. The subject sat upright with the legs hanging vertically and the knee initially bent at 90°. The trial was performed once for each leg. The values for each side were averaged as the subject's score for leg-extensor strength ((right leg + left leg)/2). The stepping rate was measured once for each side using an industrial stepping rate counter (Stepping Counter GF-300; Yagami, Nagoya, Japan); while sitting, the subject was instructed to step with each leg as rapidly as possible for 10 s. The stepping rate for each side was also averaged as the subject's score. The one-leg standing time was the number of seconds the subject was able to stand on one leg (with eyes open) without hopping or putting the raised foot down, or until 2 min had elapsed. Each subject took instructions from a study investigator, who observed the test from beginning to end. One trial was performed on the right and one on the left leg, and the average value from each side measurement was considered to be the individual's score. Walking speed was the number of seconds it took the subject to walk 10 m. The trial was done twice, with the average value taken as the score for the subject.

Still in 1997, 185 of the 207 participants in 2002, i.e., at their 5 years younger age had undergone similar fitness examinations (Takata et al., 2007). Measurements of physical fitness included handgrip strength, leg-extensor strength, one-leg standing time, and stepping rate, with the numbers of subjects participating in these tests being 185, 173, 174, and 176, respectively. Tests of walking were not done in 1997.

To evaluate the HRQoL, SF-36 (the Japanese version 1.2) was adopted, in which one item assesses the perceived change in health status, and the remaining 35 items assess physical and mental components of health. The former consists of 4 scales: PF, RP, BP, and GH, and the latter consists of 4 scales: VT, SF, RE, and MH. GH, VT, and SF have both components of health: physical and mental (Ware and Sherbourne, 1992; Hays et al., 1993; McHorney et al., 1993). Additionally, the PCS and MCS were calculated by a factor-analytic method. These scales and scores ranged from 0 to 100, with a high score indicating better QoL. All subjects were asked to fill out SF-36 in 2002, and 186 individuals completed SF-36. QoL was not assessed in 1997. Medical questionnaires including factors such as current smoking, alcohol drinking, regular medical care, marital status, and history of stroke were administered in 2002. Blood pressure measurement and blood sampling were also carried out to measure serum levels of albumin and blood levels of hemoglobin (Hb) and glycosylated-Hb (HbA1c).

All data are reported as the mean ± S.D. Differences in mean values between groups were assessed by an unpaired or paired *t*-test, as appropriate. Correlations between QoL and physical fitness measurements were assessed by simple regression analysis. Multiple regression analysis was carried out to evaluate the relationship between SF-36-scores and physical fitness measurements after adjustment for confounding variables. Logistic regression was also used to determine which fitness measurements were associated with a better QoL score. All statistical analyses were performed using SPSS 15.0 (SPSS Japan Inc., Tokyo, Japan). Results were considered statistically significant when $p < 0.05$.

3. Results

Mean scores for each scale of SF-36 were as follows: 68.1 ± 24.5 for PF, 66.9 ± 41.3 for RP, 70.1 ± 26.7 for BP, 67.3 ± 20.0 for GH, 70.1 ± 21.6 for VT, 87.2 ± 21.6 for SF, 76.1 ± 39.9 for RE, 79.0 ± 19.6 for MH, 50.0 ± 10.0 for PCS, and 54.4 ± 8.4 for MCS. Handgrip strength of the right side (25.8 ± 7.3 kg vs. 21.3 ± 6.8 kg, $p < 0.005$), handgrip strength of the left side (24.4 ± 6.8 kg vs. 20.0 ± 6.6 kg, $p < 0.005$), and leg-extensor strength (23.8 ± 7.3 kg vs. 22.6 ± 8.7 kg, $p < 0.05$) were stronger in 80-year-olds than in 85-year-olds, and one-leg standing time (17.6 ± 25.4 s vs. 8.1 ± 11.2 s, $p < 0.005$) was longer in the former than in the latter. There was no difference in the stepping rate of legs. Walking speed, which was examined only in 80-year-olds, was 6.5 ± 1.7 s over 10 m. Gender differences were apparent in all fitness measurements of populations of both 80-year-olds and 85-year-olds. QoL as assessed by SF-36 showed that PF, RP, BP, GH, VT, SF, RE, MH, PCS, and MCS were similar between men and women.

Correlation coefficients by simple regression analysis are shown in Table 1. The handgrip strength on both the right and left sides in 85-year-olds was correlated with PF, BP, and PCS. The leg-extensor strength of 85-year-old subjects was related not only to PF, BP, and PCS, but also GH, VT, MH, and MCS. Similarly, walking speed over 10 m was related to various SF-36 scales: PF, RP, BP, GH, VT, RE, and PCS. One-leg standing time was related only to PF. Physical fitness measurements in 80-year-olds were partly related to QoL in 85-year-olds. The handgrip strength on the left side in 80-year-olds was slightly related to PF. The leg-extensor strength of 80-year-olds was associated with PF and BP. The stepping rate of 80-year-olds' legs was associated with PF, BP, GH, VT, and MCS. No association was found in QoL with handgrip strength of the right side or the one-leg standing time of 80-year-olds.

An association between QoL in 85-year-olds and physical fitness measurements in 85-year-olds and 80-year-olds also was evaluated by multiple regression analysis, being adjusted with