

Sedentary behavior & health-related quality of life among congestive heart failure patients



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ABSTRACT

Background: Previous research demonstrates that participation in light-intensity physical activity (LIPA) and moderate-to-vigorous physical activity (MVPA) are favorably associated with health-related quality of life (HRQOL). Emerging work demonstrates that sedentary behavior (SB) is detrimentally associated with various cardiometabolic biomarkers, with few studies exploring the association of SB on HRQOL, and no studies examining this among congestive heart failure patients. Therefore, the purpose of this study was to examine the potential independent associations of SB on HRQOL among congestive heart failure patients.

Methods: Data from the 2003–2006 National Health and Nutrition Examination Survey were used. Physical activity was assessed over 7 days during all waking hours using the ActiGraph 7164 accelerometer. HRQOL was assessed using the Centers for Disease Control HRQOL index survey.

Results: 190 participants self-reported a physician-diagnosis of congestive heart failure. After adjustments, SB behavior (1-min/day increase) was associated with worse HRQOL ($\beta = 0.004$; 95% CI: 0.0004–0.007; $P = 0.03$). When MVPA was added as a covariate to this model, SB remained significantly associated with worse HRQOL ($\beta = 0.003$; 95% CI: 0.0001–0.007; $P = 0.04$). However, when adding LIPA to this model that also included MVPA as a covariate, SB was no longer associated with HRQOL ($\beta = 0.0001$; 95% CI: -0.003 –0.004; $P = 0.92$).

Conclusions: If confirmed by prospective/experimental work, this suggests that SB may not have detrimental HRQOL effects among congestive heart failure patients.

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1. Introduction

A considerable amount of research demonstrates that participation in moderate-to-vigorous physical activity (MVPA) is favorably associated with health-related quality of life (HRQOL) [1–10], with emerging research also demonstrating that light-intensity physical activity (LIPA) is associated with HRQOL [11–15]. Recent research suggests that, independent of physical activity, sedentary behavior (SB) is associated with unfavorable cardiometabolic-related outcomes [16–25]. Little research among adults, however, has examined the independent associations of SB on HRQOL [26–34]. No study has specifically examined the independent associations of SB on HRQOL among congestive heart failure patients, which is important to explore as congestive heart failure patients have poorer HRQOL [35] and may be intolerant to higher-intensity physical activity engagement [36]. Thus, the purpose

of this study was to examine the association of SB on HRQOL among congestive heart failure patients.

2. Methods

2.1. Study design and participants

Data from the population-based 2003–2006 National Health and Nutrition Examination Survey (NHANES) were used; these cycles were evaluated as, at the time of this writing, these are the only cycles with objectively-measured physical activity data. Briefly, NHANES employs a population-based sample of Americans via household interviews and examinations in a mobile examination center. Using a multistage, complex probability design, non-institutionalized U.S. civilians are selected for participation. Further details about NHANES can be found on their website (<http://www.cdc.gov/nchs/nhanes.htm>). In these cycles, 190 participants self-reported a physician-diagnosis of congestive heart failure and had complete data on the study variables.

2.2. Measurement of SB, LIPA and MVPA

Sedentary behavior, LIPA and MVPA were assessed for up to 7 days using an ActiGraph 7164 accelerometer; activity counts/min < 100 defined SB; [37] between and inclusive of 100 and 199 were used to define LIPA [38], with counts/min ≥ 2020 defined as participation in MVPA [39]. Only those having at least 4 days of 10+ hours/day of monitoring were included in the analyses. Nonwear time was identified as ≥ 60 consecutive minutes of zero activity counts, with allowance for 1–2 min of activity counts between 0 and

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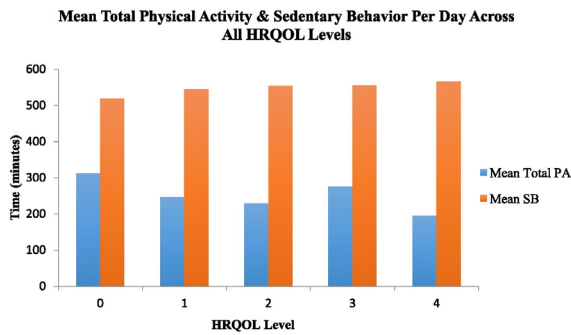


Fig. 1. Mean total physical activity & sedentary behavior per day across all HRQOL levels. Mean total PA = average total amount of physical activity accumulated throughout the day (including light, moderate, and vigorous physical activity). Mean SB = average total amount of sedentary behavior accumulated throughout the day.

100. Specific details regarding the NHANES accelerometer protocol have been previously published [40].

2.3. Measurement of HRQOL

The CDC HRQOL measure was assessed from 4 questions, including 1 question about self-rated health status and 3 about the number of unhealthy days during the past 30 days [41,42]:

1. "Would you say that in general your health is excellent, very good, good, fair, or poor?"
2. "Now thinking about your physical health, which includes physical illness and injury, how many days during the past 30 days was your physical health not good?"
3. "Now thinking about your mental health, which includes stress, depression, and problems with emotions, how many days during the past 30 days was your mental health not good?"
4. "During the past 30 days, approximately how many days did poor physical or mental health keep you from doing usual activities, such as self-care, work, or recreation?"

The 4 CDC HRQOL items were categorized according to CDC's recommendations, which included question 1 dichotomized as good/excellent health (coded as 0) or poor/fair health (coded as 1). The latter 3 items were dichotomized as 14 or more days (coded as 1) and less than 14 days (coded as 0).

Thus, the recoded 4 HRQOL items ranged from 0 to 1. An overall HRQOL score was created by summing the responses from each of the 4 individual items (range: 0–4), with higher HRQOL scores indicating worse HRQOL. In this sample of congestive heart failure patients, the mean HRQOL was 1.05; 41.0%, 28.8%, 18.1%, 7.9% and 4.2%, respectively, had a HRQOL score of 0, 1, 2, 3, and 4. The HRQOL-4 developed by CDC has undergone extensive reliability and validity testing and has demonstrated adequate psychometric properties [43–47].

All statistical analyses were computed in Stata (v. 12) and accounted for the complex survey design of NHANES to adjust for non-compliance, non-response and to render nationally representative estimates. Multivariable ordinal regression was employed to examine the association between SB and HRQOL. The following covariates were included: age (years; continuous); gender; race-ethnicity (non-Hispanic white vs. other); self-reported smoking status (current smoker vs. not); measured body mass index (kg/m²; continuous); education attainment (college or more vs. less); C-reactive protein (mg/dL; continuous); and physician diagnosed coronary artery disease (yes vs. no). Statistical significance was established as $P < 0.05$.

3. Results

Physical activity and sedentary behavioral levels across the HRQOL scores are shown in Fig. 1.

Among these congestive heart failure patients, the mean age was 66.7 years; mean body mass index was 31.1 kg/m²; 56.2% were males; 79.6% were non-Hispanic white; mean C-reactive protein was 0.61 mg/dL; mean HRQOL was 1.05; 36.8% had a physician diagnosis of coronary artery disease; and mean SB, LIPA, and MVPA, respectively were 537.0 min/day, 261.6 min/day, and 8.6 min/day. All demographic characteristics of the sample can be found in Table 1.

After adjustments, SB behavior (1-min/day increase) was associated with worse HRQOL ($\beta = 0.004$; 95% CI: 0.0004–0.007; $P = 0.03$). When MVPA was added as a covariate to this model, SB remained significantly associated with worse HRQOL ($\beta = 0.003$; 95% CI: 0.0001–0.007; $P = 0.04$). However, when adding LIPA to this model that also included

Table 1

Weighted characteristics of the analyzed sample, 2003–2006 NHANES (N = 190).

Characteristics	Mean/Proportion	95% CI
Demographic characteristics		
Age	66.7	63.5–70.0
Male (%)	56.2	47.5–64.8
Race/ethnicity (%)		
Non-Hispanic white	79.6	74.5–84.8
Other	20.4	15.2–25.5
Physical activity patterns		
Mean Daily SB (min/day)	537.0	515.2–558.8
Mean Daily LIPA (min/day)	261.6	244.2–279.1
Mean Daily MVPA (min/day)	8.6	5.6–11.5
Individual health status		
HRQOL (range = 0–4)	1.05	.83–1.28
BMI (m ² /kg)	31.1	29.8–32.3
CRP (mg/dL)	.61	.48–.75
CAD (%)	36.9	27.1–46.7
Smoker (%)	19.2	13.1–25.3

CI = confidence interval.

SB = sedentary behavior.

LIPA = light-intensity physical activity.

MVPA = moderate-to-vigorous physical activity.

HRQOL = health-related quality of life.

CRP = C-reactive protein.

CAD = coronary artery disease (expressed as the percentage who reporting having diagnosed CAD).

Smoker = percentage who reported being a smoker (vs. non-smoker).

MVPA as a covariate, SB was no longer associated with HRQOL ($\beta = 0.0001$; 95% CI: -0.003 – 0.004 ; $P = 0.92$).

4. Discussion

A growing body of literature suggests that both LIPA and MVPA are favorably associated with HRQOL among various populations, with emerging work also demonstrating that SB is independently associated with HRQOL among the broader population. No study, to our knowledge, has evaluated the independent association of SB on HRQOL among congestive heart failure patients. The present analyses demonstrated that after controlling for MVPA, SB remained significantly associated with HRQOL. However, after controlling for overall physical activity (LIPA + MVPA), SB was no longer significantly associated with HRQOL. This latter finding is very similar to a recent paper looking at the independent associations of SB, MVPA and overall physical activity on cardiometabolic-related parameters [48]. Maher et al. [48] demonstrated that SB was detrimentally associated with 8 out of 11 cardiometabolic biomarkers when adjusting for MVPA. However, when adjusting for total physical activity (LIPA + MVPA), the association between SB and cardiometabolic parameters effectively disappeared. A possible explanation for the observed finding that MVPA did not reduce the significant SB-HRQOL relationship is that perhaps the average daily MVPA (8.6 min/day) alone was not a sufficient dose of physical activity. The literature supports a dose–response relationship between physical activity and a number of health outcomes (e.g., an inverse, dose–response relationship with cardiovascular disease incidence and mortality) [49,50], which lends some credence to our observation of the SB-HRQOL relationship only being attenuated once the much higher volume of total physical activity (MVPA + LIPA = 270.2 min/day) was accounted for.

The previously mentioned results suggest that it may be more beneficial to promote PA in CHF patients, as opposed to encouraging a reduction in sedentary behavior. Notably, numerous exercise studies have demonstrated positive effects of exercise on health (e.g., reduced mortality, improved muscle strength and improved HRQOL) [51–53], with previous PA intervention protocols including running or cycling at 60–80%⁵² of peak VO_{2max} and circuit-style strength training procedures [54], for instance. An American Heart Association (AHA) scientific statement on exercise and heart failure [55] indicated that little work has been done to

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