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LETTER TO THE EDITOR

Autonomic dysfunction in myalgic encephalomyelitis and chronic fatigue syndrome: comparing self-report and objective measures

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Dear Editors:

Myalgic encephalomyelitis (ME) and chronic fatigue syndrome (CFS) have debilitating impacts on affected individuals. Core symptoms include post-exertional malaise, neurocognitive challenges, and sleep dysfunction [1]. Additionally, a significant minority of patients experience autonomic symptoms, including orthostatic intolerance, gastrointestinal disturbances, and circulation issues [2].

Several case definitions for ME and CFS require the presence of autonomic dysfunction for diagnosis [2], while other researchers have proposed an "autonomic dysfunction" subtype of ME and CFS [3]. Identifying the appropriate measures of autonomic symptomatology for individuals with ME and CFS will further contribute to understanding the role of the autonomic system in this illness.

Heart rate variability (HRV), a measure of the variation in time between heart beats, has been utilized as an objective measurement of autonomic functioning in ME and CFS research, and some researchers have suggested that HRV could be utilized as a "potential bedside diagnostic tool" for ME and CFS [4]. HRV can be divided into two major components, the low-frequency (LF) component, indicative of sympathetic dominance, and the high-frequency (HF) component, indicative of parasympathetic dominance. In addition, the LF to HF ratio is considered to be an indicator of sympatho-vagal balance [5].

As objective measures can be costly and time-intensive, some researchers utilize self-report measures of autonomic symptoms. Previous research has compared results from the self-report Composite Autonomic Symptom Scale (COMPASS) [6] and HRV and found a significant negative correlation between LF-HRV and COMPASS scores [7]. The aim of the study reported here was to extend upon this body of literature by examining the association between HRV and autonomic items from another self-report measure, the DePaul Symptom Questionnaire (DSQ) [8].

The study protocol was approved by the ethical review board (ethical approval number: 12/NE/0146) of the Royal Victoria Infirmary (Newcastle upon Tyne, UK). Informed consent from participants was obtained by staff trained in Good Clinical Practice guidelines. All participants ($n=141$) met the Fukuda et al. (1994) criteria for CFS [9]. After completing the DSQ, participants underwent a battery of autonomic tests (described below) using the Task Force® Monitor program version 2.2 (CNSystems Medizintechnik GmbH, Graz, Austria).

The mean age of the participant cohort was 45.9 (standard deviation 13.6) years; 80.9% were female, and 98.6% were Caucasian. While over half of the participants (51.5%) held Bachelor's or graduate degrees, only 35.8% were working at the time of the study. Additionally, 35.0% of the sample reported being on disability (the remainder of the sample comprised students, homemakers, and individuals who were unemployed or retired).

The DSQ is a freely-available, reliable diagnostic measure of both core and subtyped symptoms of ME/CFS [3, 8] and includes seven items related to autonomic symptoms: bladder problems; irritable bowel problems; nausea; feeling unsteady on feet (like you might fall); shortness of breath or trouble catching your breath; dizziness or fainting; and irregular heartbeats. Participants rated the frequency and severity of each symptom for the preceding 6 months. Frequency ratings ranged from 0 (symptom not present) to 4 (all of the time). Severity ratings ranged from 0 (symptom not present) to 4 (very severe). A composite score was calculated for each symptom by multiplying the frequency and severity ratings by 25 (to form a 100-point scale) and averaging the symptom's frequency and severity scores.

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Table 1 Correlation matrix of self-report and objective autonomic measures

Self-report symptoms	LFnu	HFnu	LF:HF
Nausea	− 0.265**	0.275**	− 0.220**
Dizziness or fainting	− 0.207*	0.211**	− 0.113
Irregular heart beats	− 0.174*	0.182*	− 0.099
Feeling unsteady on feet	− 0.178*	0.174*	− 0.079
Bladder problems	− 0.027	0.035	− 0.084
Irritable bowel problems	− 0.126	0.123	0.001
Shortness of breath	− 0.091	0.102	− 0.096

LFnu Mean low-frequency normalized units, *HFnu* mean high-frequency normalized units, *LF:HF* ratio of low-frequency component of heart rate variability (HRV) to high-frequency component of HRV

*$p < .05$; **$p < .01$

After the participants had completed the DSQ, their autonomic functioning was recorded using the Task Force® Monitor program version 2.2. The protocol was conducted by trained staff and included 10 min of rest (supine), followed by a 2-min active stand, and the Valsalva maneuver. The Task Force® Monitor provided a report for each participant that included mean heart rate (beats per minute); mean systolic blood pressure (mmHg); mean diastolic blood pressure (mmHg); mean HF (ms^2); mean LF (ms^2); mean HF normalized units (HFnu, %); mean LF normalized units (LFnu, %); mean very LF (ms^2); mean power spectral density (ms^2); ratio of LFnu to HFnu (LFnu:HFnu); ratio of LF to HF (LF:HF); baroreceptor slope mean (ms/mmHg); and baroreflex effectiveness index (%). In the current study we focused on normalized measures of HRV (LFnu, HFnu, and LFnu:HFnu).

The fast Fourier transformation was used to convert HRV signals (variation in time between heart beats) to power spectral density. LF was defined as frequencies ranging between 0.04 and 0.15 Hz, and HF was defined as frequencies of > 0.15 Hz. LFnu (indicative of sympathetic dominance) was calculated as LF/(LF + HF); HFnu (indicative of parasympathetic dominance) was calculated as HF/(LF + HF). The LF:HF ratio is an indicator of balance between the sympathetic and parasympathetic systems [5].

Pearson correlation coefficients were calculated to investigate the relation between the HRV measures and DSQ items (Table 1). The results indicated that LFnu (sympathetic) was negatively correlated with self-reported nausea, dizziness or fainting, irregular heart-beats, and feeling unsteady on feet, while HFnu (parasympathetic) was positively correlated with self-reported nausea, dizziness or fainting, irregular heart beats, and feeling unsteady on feet. Finally, the LF:HF ratio was negatively correlated with self-reported nausea. The remaining correlations were not significant.

The results of this analysis provide some support for consistency between participants' reports of autonomic symptoms on the DSQ and objective measures of autonomic symptomatology. As the self-report items in the current study referred to the preceding 6 months of an individual's symptoms, while the objective tests measured symptoms at the exact moment of the study, high correlation coefficients were not expected. The results further support previous research [7] indicating that individuals are accurate reporters of autonomic symptoms.

This study had several limitations: its sample was small, demographically homogenous, and referral based; therefore, additional research is required to verify the study's findings. Despite these limitations, the results provide initial evidence of the construct validity of the DSQ's autonomic items and indicate that individuals with ME and CFS are accurate reporters of autonomic symptoms.

In addition to providing evidence for the construct validity of DSQ items, this finding of accurate self-reporting of autonomic symptoms by individuals is significant in that previous studies have found that individuals with ME and CFS often face de-legitimization by physicians and loved ones [10]. Validating the individual's self-reported symptoms using objective data, such as HRV, may help in reducing stigma towards individuals with ME and CFS.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval This study received approval by the appropriate ethics committees and was performed in accordance with the ethical standards specified in the 1964 Declaration of Helsinki and its later amendments.

Informed consent All participants provided informed consent prior to their inclusion in the study.

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