

## **Information processing efficiency in chronic fatigue syndrome and multiple sclerosis.**

DeLuca J, Johnson SK, Natelson BH. (1993)

Department of Physical Medicine and Rehabilitation, University of Medicine and Dentistry of New Jersey-New Jersey Medical School, Newark.

**OBJECTIVE**--To compare the cognitive performance of subjects with chronic fatigue syndrome (CFS), multiple sclerosis (MS), and healthy controls. All subjects were matched for age, education, and verbal intelligence, as previous neuropsychological studies of CFS had not used appropriate control groups. **DESIGN**--Case-control design. All subjects were given a neuropsychological battery and the test scores were compared among the groups. **SETTING**--Subjects with CFS and subjects with MS were recruited from private and institutional practice and from the community. Healthy subjects were recruited from the community. **PATIENTS/OTHER PARTICIPANTS**--Twelve subjects (all female) with CFS participated in the study. Chronic fatigue syndrome was diagnosed in these patients in accordance with the requirements outlined by the Centers for Disease Control as modified subsequently to not exclude patients with concurrent depression and/or anxiety. All subjects with CFS were referred for a neuropsychological examination to assess persistent cognitive complaints. Eleven subjects (10 female, one male) with the diagnosis of clinically stable MS were chosen from clinics and the community because of complaints of mild to moderate cognitive impairment. The subjects with MS and 11 healthy volunteers (10 female, one male) were matched to the group with CFS by age, education, and estimated verbal intelligence (based on the Vocabulary subtest of the Wechsler Adult Intelligence Scale-Revised). The subjects with MS had a mean Kurtzke Expanded Disability Status Scale score of 4.95 (SD, 1.95; range, 2.0 to 7.5). As a result of the matching procedure, there were no differences among the three groups in age ( $F[2,31] = 0.32$ ), education ( $F[2,31] = 0.80$ ), and verbal intelligence ( $F[2,31] = 0.31$ ). **INTERVENTIONS**--None. **MAIN OUTCOME MEASURES**--These measures included the Beck Depression Inventory (BDI), the Paced Auditory Serial Addition Test (PASAT), Digit Span Test, and the Similarities Test of Verbal Abstract Reasoning. **RESULTS**--The mean number of correctly identified responses collapsed across the four PASAT trials was significantly different across groups ( $F[2,31] = 4.03$ ;  $P < .05$ ). While the CFS and MS groups did not differ from each other, subjects with CFS (SEM, 124.2 +/- 6.4) and subjects with MS (SEM, 112.9 +/- 10.9) scored significantly below controls (SEM, 146.4 +/- 6.4) (Fisher's Protected Least Significant Difference test;  $P < .05$ ). There were significant differences among the three groups on mean Digit Span Test performance ( $F[2,31] = 5.5$ ;  $P < .01$ ). While the CFS and MS group did not differ significantly from each other, only the CFS group was significantly lower than control (Fisher's Protected Least Significant Difference test;  $P < .05$ ). Mean performance on the Similarities test did not differ among the three groups ( $F = 0.58$ ). In addition, there were significant differences among the three groups in mean BDI scores ( $F[2,31] = 7.6$ ;  $P < .01$ ). The CFS and MS groups did not differ significantly from each other, and both groups showed a statistically significantly elevated mean BDI score relative to the control group (Fisher's Protected Least Significant Difference test;  $P < .05$ ). No significant

correlations were found between BDI scores and PASAT total scores (CFS,  $r = -.21$ ; MS,  $r = .13$ ; control,  $r = .27$ ), or between BDI and Digit Span Test (CFS,  $r = -.32$ ; MS,  $r = -.40$ ; control,  $r = -.19$ ). Results of the PASAT and Digit Span Test were significantly correlated in the CFS group ( $r = .71$ ;  $P < .01$ ), but not in the MS ( $r = .06$ ) or control groups ( $r = .49$ ). CONCLUSIONS--These results indicate that subjects with CSF and subjects with MS show significant impairment on a test of complex concentration when compared with appropriate controls. The data suggest that subjects with CFS and subjects with MS have difficulty on tasks that require the simultaneous processing of complex cognitive information. Selective impairment in information processing efficiency may lie at the [text missing at PubMed]

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