

# Oxidative stress levels are raised in chronic fatigue syndrome and are associated with clinical symptoms

**Authors:** Gwen Kennedy, Vance A Spence, Margaret McLaren, Alexander Hill, Christine Underwood and Jill JF Belch

**Institution:** Vascular Diseases Research Unit, The Institute of Cardiovascular Research, Ninewells Hospital and Medical School, Dundee, Scotland, UK

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**Introduction:** The aetiology of chronic fatigue syndrome (CFS) is unknown; however, recent evidence suggests that excessive free radical (FR) generation may be involved. This study investigated for the first time levels of 8-iso-prostaglandin-F2a-isoprostanes alongside other plasma markers of oxidative stress in CFS patients and control subjects.

**Methods:** Forty-seven patients (18 males, 29 females, mean age 48 [19–63] years) who fulfilled the Centres for Disease Control classification for CFS and 34 sex and age-matched healthy volunteers (13 males, 21 females, 46 [19–63] years) were enrolled in the study. The CFS patients were divided into two groups: those with previously defined cardiovascular risk factors of obesity and hypertension (group 1) and those who were normotensive and non-obese (group 2). Blood samples were collected, from which red blood cell GSH levels were measured on a spectrophotometer, oxidised low-density lipoprotein levels were measured by ELISA, plasma isoprostanes were measured by gas chromatography–mass spectrometry, and high-density lipoprotein levels were measured on a Cobas Bio centrifugal analyser.

**Results:** Patients with CFS had significantly increased levels of isoprostanes (group 1,  $p=0.007$ ; group 2,  $p=0.03$ ) and oxidised low-density lipoproteins (group 2,  $p=0.02$ ), compared with controls, indicative of a FR attack on lipids. Patients also had significantly lower high-density lipoproteins (group 1,  $p=0.011$ ; group 2,  $p=0.005$ ), and lower levels of the antioxidant GSH ( $p=0.05$ ). CFS symptoms correlated with isoprostane levels (total symptom score,  $p=0.005$ ; joint pain,  $p=0.002$ ; post-exertional malaise,  $p=0.027$ ), but only in group 2 CFS patients with low cardiovascular risk.

**Conclusion:** This new data provides further evidence of dysfunction to oxidative pathways in CFS. The finding of high levels of isoprostanes in people with CFS is particularly important given this measure's sensitivity, reliability and correlation with other measures of lipid peroxidation in vivo. Furthermore, isoprostanes may not only be markers of oxidative injury, but may in fact mediate the effects of free radicals and reactive oxygen species.

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