Effects of work and life stress on semen quality

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Objective: To evaluate associations between work-related stress, stressful life events, and perceived stress and semen quality.
Design: Cross-sectional analysis.
Setting: Northern California.
Patient(s): 193 men from the Child Health and Development Studies evaluated between 2005–2008.
Intervention(s): None.
Main Outcome Measure(s): Measures of stress including job strain, perceived stress, and stressful life events; outcome measures of sperm concentration, percentage of motile sperm, and percentage of morphologically normal sperm.
Result(s): We found an inverse association between perceived stress score and sperm concentration (estimated coefficient b = −0.09 × 10^3/mL; 95% confidence interval [CI] = −0.18, −0.01), motility (b = −0.39; 95% CI = −0.79, 0.01), and morphology (b= −0.14; 95% CI, −0.25, −0.04) in covariate-adjusted linear regression analyses. Men who experienced two or more stressful life events in the past year compared with no stressful events had a lower percentage of motile sperm (b= −8.22; 95% CI, −14.31, −2.13) and a lower percentage of morphologically normal sperm (b = −1.66; 95% CI, −3.35, 0.03) but a similar sperm concentration. Job strain was not associated with semen parameters.
Conclusion(s): In this first study to examine all three domains of stress, perceived stress and stressful life events but not work-related stress were associated with semen quality. (Fertil Steril® 2014;■:■–■. ©2014 by American Society for Reproductive Medicine.)
Key Words: Semen quality, stress, work

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Semen quality is a key marker of male reproductive health. Identifying the psychosocial risk factors such as stress for poor semen quality is important for improving fecundity and fertility, and may also have implications for life course and intergenerational health (1). However, the research examining the association between psychosocial stress and semen quality has been inconsistent. In studies examining life stress, one prospective study found no association (2), another study found positive results for only one particular stressful life event (death of a family member) (3), and others were inconsistent in regard to the semen parameter with which an association was found (3–6). One study of work stress found an inverse association with semen quality (7), but two others did not (2, 3).

Several reasons may explain the inconsistent associations. First, many studies are based on populations of couples from prenatal clinics or infertility clinics, which are select populations who may not reflect the levels of stress or semen quality in a more general population. Second, no previous study has included both subjective and objective validated measures of stress as well as measures in both work and life domains. Subjective measures of stress focus on an individual's perception of his ability to cope with the demands of events, whereas objective measures of stress assess experiences thought to be universally associated with a stress response (8); both may be necessary to characterize stress in relation to male reproductive health.

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Our objective was to examine sperm concentration, motility, and morphology in association with work stress and both subjective and objective measures of life stress in a sample of 193 healthy men aged 38 to 49 years from the general population in northern California. We hypothesized that lower job control, higher job demands, higher perceived stress, and a higher number of stressful life events would be associated with poorer semen quality. Additionally, we explored a potential neuroendocrine pathway between stress and semen measures by examining covariate-adjusted associations between stress measures and reproductive hormones—total testosterone and follicle-stimulating hormone (FSH)—and between reproductive hormones and semen measures.

MATERIALS AND METHODS

Study Population

This cross-sectional analysis used data collected from men aged 38 to 49 years as part of the Study of the Environment and Reproduction (SER) follow-up to the Child Health and Development Studies (CHDS). The CHDS is a pregnancy cohort study conducted among members of Kaiser Foundation Health Plan in the Oakland, California, area. Over 15,000 women participated between 1959 and 1966, resulting in about 20,000 pregnancies. One of a series of follow-up studies launched in 2005 to explore how fetal and childhood growth and development affect adult health, SER was designed to investigate the effects of prenatal organochlorine exposure on men's reproductive health (9, 10). To become participants, the couples were required to have birth length and weight data, maternal interview data, sufficient second-trimester and postpartum serum available for serologic measures, and to live within approximately 100 miles of the Kaiser Oakland Clinic. Out of 3,531 eligible patients, 654 were traced, 338 of whom (52%) qualified and agreed to participate. Of those, 196 (58%) provided semen samples for analysis. This report is based on the 193 who provided a semen sample and for whom we were able to calculate subject and objective stress scores. The institutional review boards at Columbia University Medical Center, Kaiser Permanente, and the Public Health Institute approved this study.

Data Collection

Data were collected between December 2005 and April 2008. The men traveled to the clinic for 1-hour in-person interviews in which they provided extensive demographic, lifestyle, and occupational information. There were no exclusion criteria for participation, but detailed health and reproductive histories were taken to be considered for later exclusion if necessary. Subsequent to the interview, men were asked to provide semen samples followed by blood samples.

Stress Measures

As part of the in-person interview, participants completed three stress scales to measure work stress and both subjective and objective life stress. Among employed men, work stress over the past 3 months was assessed using 16 items from the Job Content Questionnaire (JCQ) (11). The time frame of 3 months was chosen to correlate with the period of spermatogenesis, approximately 72 days (1). The JCQ measures job characteristics among two dimensions—job demands and job control—and can be characterized as an assessment of the psychological and social structure of the work situation. Respondents are asked their agreement on a Likert scale for job demand items such as "I have time to get my work done," and job control items such as "At my job, I am given a lot of freedom to decide how I do my work." We calculated quantitative demands and control dimensions based on recoding for directionality and summing, with a higher score indicating greater job demands or greater job control. We then combined these to create a dichotomous job strain variable by categorizing those subjects above the median job demand score (median score: 32, range: 12–48) and below the median job control score (median score: 74, range: 26–96) as "high job strain." An additional question was asked regarding the security of the men's current job. We collapsed the 4-point Likert scale response to create a dichotomous security variable (1 = strongly agree/agree; 0 = strongly disagree/disagree).

To measure subjective stress, participants were asked to complete a validated abbreviated version (10 out 14 items) of the Perceived Stress Scale (PSS) (12). The PSS measures how often events are perceived as stressful by asking about feelings during the last month. For example, "During the last month, how often have you felt that things were going your way?" Items in the PSS were scored on a 5-point frequency scale (0 = never, 4 = very often). After recoding for consistent directionality, we summed response numbers to yield a quantitative total PSS score, with a higher score indicating greater perceived stress.

Participants also completed a validated shortened version of the Life Events Inventory (LEI) (13), including the top 10 stressors identified by men in an occupational sample (14), to provide an objective measure of stressful events experienced over the past year. The number of events was summed, and a 3-level ordinal categorical LEI score was used for analysis: 0, 1, and ≥ 2 negative life events based on the distribution of the variable and to be consistent with previous literature (6).

Semen Quality Measures

Men were asked to provide two semen samples approximately 2 weeks apart, remaining abstinent for 2 to 5 days before each donation. Samples were given at the Kaiser clinic and only counted if all of the ejaculate was captured in the provided container; if not, the man was asked to return for an additional visit. Men were asked the date and time of their last ejaculation, and the date and time of the sample collection were also recorded. Analysis was conducted by three andrology technicians trained at the University of California–Davis (UCD), according to the same protocol used by the National Institute of Child Health and Human Development–funded National Cooperative Reproductive Medicine Network (Fertile Male Study) (15). Briefly, within 1 hour of sample collection at the Kaiser clinic, technicians measured the ejaculate's volume by weight and determined the sperm concentration and