The relationship between occupational psychological stress and female fertility

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Objective
To investigate the association between occupational psychological stress and female fertility.

Methods
This was a case–control study including consecutive working female patients attending fertility and in vitro fertilization clinics in the Soroka University Medical Center. We compared occupational stress between 64 working patients who had attended the clinics due to female infertility (case group) and 106 working patients who had attended the clinics due to their partner’s reproductive impairment (control group).

Results
Patients from the female infertility group were older (31.9 ± 6.2 versus 30.2 ± 4.6, \(P = 0.047\)) and tended to participate more in sporting activity (23.4 versus 10.4%, odds ratio (OR) = 2.6, 95% confidence interval (CI) = 1.05–6.73, \(P = 0.022\)) as compared with patients from the male infertility group. Patients from the case group tended to work more weekly hours as compared with the controls (33.6 ± 16.8 versus 26.9 ± 17.4, \(P = 0.028\)). High reliability was found, as demonstrated by Cronbach’s \(\alpha\) of 0.81–0.90 for the four burnout parameters. Patients from the female infertility group had significantly lower listlessness scores as compared with the control group, using the Mann–Whitney test (2.6 ± 1.1 versus 3.1 ± 1.2, \(P = 0.013\)).

Conclusions
Patients admitted due to female infertility tended to have lower listlessness scores as compared with patients admitted due to their partner’s infertility problem. No significant association was found between other burnout, job strain and job satisfaction scores and women’s fertility status.

Key words
Female infertility; listlessness; occupational psychological stress; physical activity.

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Introduction
Psychological distress has long been suspected as having an important impact on infertility [1–6]. In both sexes, psychological factors were found to be predictors of the couple’s fertility status [3–6]. However, it is still not completely understood whether psychological stress is part of the aetiology of infertility as a causal factor or whether it appears as a consequence of the overall infertility problem.

While other aspects of work, mainly exposures to substances, radiation, etc., have been investigated, an important but less investigated aspect of infertility is the influence of working conditions and psychological distress in the workplace on female infertility. Indeed,
working outside the home was found to result in an increased vulnerability to stress, which was found to be associated with a poor outcome of in vitro fertilization and embryo transfer treatment [7]. Likewise, Brett et al. [8] suggested that chronic exposure to high stress at work during pregnancy might lead to preterm delivery.

The present study aimed to investigate the influence of occupational stress on female fertility.

Materials and methods

Setting and patients

The study included all female working patients who attended the Fertility and In-Vitro Fertilization clinics in the Soroka University Medical Center, a regional teaching hospital, between October 1999 and August 2000. We compared occupational stress between patients with female infertility (case group) and patients who had attended the clinics due to their partner’s reproductive impairment, i.e. male infertility (control group). The design of the study, including only couples with infertility, enabled us to control for recall bias, explained by a tendency of individuals experiencing adverse reproductive outcome to over-report exposures [9–11]. The patients were asked to complete a questionnaire, after receiving an exact explanation concerning the purpose of the study. Likewise, the attending physician responded to another questionnaire, which included detailed medical history and laboratory tests. The study was approved by the local ethical committee and the Ministry of Health.

The inclusion criteria were working patients who spoke fluent Hebrew and who had previously given their informed consent. Only one patient chose not to participate and was excluded from the study. An additional two patients were excluded due to unknown reason for infertility. This high participation rate reduces the risk of selection bias [9,12].

Data

The following were assessed or evaluated.

- Infertility parameters: type of infertility (primary or secondary), aetiology (male, female, combined, or unexplained), number of treatment cycles, medical history and laboratory work-up.
- Socio-demographic parameters: age, ethnicity, level of education, economic status and parity.
- Lifestyle parameters: smoking, alcohol consumption, drug use, physical and sexual activities and duration of infertility.
- Work conditions and classifications: hours of work, shifts, occupational exposures to potential reproductive toxic agents (chemical and physical) and psychological stress; occupational classification was standardized according to the Central Bureau of Statistics criteria [13].

Stress questionnaire

Occupational stress was measured in three ways: burnout, job strain (including job demands and decision latitude) and job satisfaction.

Burnout

Shirom [14] defined burnout as a combination of emotional exhaustion, physical fatigue and cognitive weariness. The questionnaire included three scales measuring burnout, tension and listlessness, according to Melamed et al. [15]. This questionnaire was used among Israeli workers with high reliability coefficients—Cronbach’s $\alpha$ of 0.73–0.90 [15]. Another scale investigating cognitive weariness was added, according to Kushnir and Melamed [16], with reliability coefficients—Cronbach’s $\alpha$ of 0.70.

The burnout questionnaire had eight parameters investigating physical fatigue and emotional exhaustion on a scale of from 1 (never) to 7 (almost always), such as ‘I feel physically exhausted’ or ‘I feel tired’.

The tension and listlessness questionnaires had four parameters, using the same scale. Examples of parameters inquiring about tension included ‘I feel restless’ and ‘I feel intense inner tension’. Items measuring listlessness included ‘I feel sleepy’ and ‘I feel alert’ (reversed score), etc.

Cognitive weariness was assessed using six parameters, with the same scale. Sample items included ‘my head is not clear’ and ‘I feel I am disorganized lately’. The total score was averaged by dividing by the number of items.

Job strain

The job-strain model of Karasek et al. [17,18] was developed specifically to assess occupational stress [17–19]. The two components of the model are job demands and decisional latitude, the former being a measure of the workload and the latter investigating job control or autonomy, including personal schedule freedom and intellectual discretion. The model is conceptualized as four cells, corresponding to high and low demands and high and low decision latitude. We chose the original questionnaire, as was introduced in a Swedish study [17] reporting an association between job strain and the risk of a heart attack. The model was previously examined with regard to fertility, demonstrating significant correlation between high strain and preterm deliveries [8] and testosterone fluctuations [20].
Job satisfaction

Job satisfaction was evaluated by a simple question ‘How satisfied are you with your job?’ The answers were on a scale from 1 (unsatisfied) to 5 (extremely satisfied).

Statistical analysis

Statistical analysis was performed with the SPSS package (SPSS, Chicago, IL). To test the statistical significance of the results, the χ² test or Fisher’s exact test was used as appropriate, when qualitative data were compared. For continuous variables, the t-test was used. Odds ratios (OR) and their 95% confidence intervals (CI) were computed. P < 0.05 was considered statistically significant. Reliability coefficients using Cronbach’s α were assessed in the burnout and job strain questionnaires. The a-parametric Mann–Whitney test was used to investigate differences in psychological tests.

Results

During the study period, 200 consecutive couples had started a cycle of treatment in our clinics. Of those, 64 working patients had attended the clinics due to a female fertility problem (case group), 106 working patients had attended the clinics due to male infertility (control group) and 30 patients had a combined fertility problem (male and female). Since the study aimed to compare occupational and stress exposures among patients with female versus male infertility and due to the small number of patients with a combined cause for infertility, we excluded these last 30 patients from the analysis.

Table 1 compares the socio-demographic and health characteristics of the two groups. Patients from the female infertility group were significantly older (31.9 ± 6.2 versus 30.2 ± 4.6 years, P = 0.047) and tended to participate more in sporting activity as compared with the controls (16.8 versus 26.9 ± 17.4, P = 0.047). In addition, these patients had higher rates of secondary infertility as compared with the control group (OR = 2.5, 95% CI = 1.3–4.9, P = 0.005), although there were no significant differences regarding the number of deliveries and previous children between the groups.

Table 2 shows the types of occupation according to the cause of infertility (female versus male). Most patients worked in clerical jobs and as teachers. No significant differences were noted between the groups regarding any parameter: 0.44–0.55 for the items investigated) or job satisfaction results. However, these patients worked significantly more weekly hours as compared with the controls (33.6 ± 21.0 versus 26.9 ± 17.4, P = 0.028).

Table 4 compares burnout, job strain and job satisfaction for the two groups. High reliability was found, as demonstrated by Cronbach’s α for the four burnout parameters: 0.90 for burnout, 0.81 for tension, 0.88 for listlessness and 0.86 for cognitive weariness. Patients from the female infertility group had significantly lower listlessness scores as compared with the controls, using the Mann–Whitney test (2.6 ± 1.1 versus 3.1 ± 1.2, P = 0.013). No significant differences were noted between the groups with regard to the job strain (Cronbach’s α of 0.44–0.55 for the items investigated) or job satisfaction results.


**Table 3. Occupational characteristics of patients with female versus male infertility: exposure to potential reproductive toxic agents**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Female infertility (n = 64)</th>
<th>Controls (n = 106)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical agents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals</td>
<td>2 (3.1%)</td>
<td>2 (1.9%)</td>
<td>0.605</td>
</tr>
<tr>
<td>Pesticides</td>
<td>1 (1.6%)</td>
<td>3 (2.8%)</td>
<td>0.485</td>
</tr>
<tr>
<td>Solvents</td>
<td>3 (4.6%)</td>
<td>4 (3.8%)</td>
<td>0.936</td>
</tr>
<tr>
<td>Physical agents</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td>9 (14.14%)</td>
<td>10 (9.4%)</td>
<td>0.353</td>
</tr>
<tr>
<td>Radiation</td>
<td>2 (3.1%)</td>
<td>3 (2.8%)</td>
<td>0.912</td>
</tr>
<tr>
<td>Solar radiation</td>
<td>5 (7.8%)</td>
<td>10 (9.4%)</td>
<td>0.522</td>
</tr>
<tr>
<td>Heat</td>
<td>2 (3.1%)</td>
<td>3 (2.8%)</td>
<td>0.912</td>
</tr>
<tr>
<td>Physical effort during work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult</td>
<td>13 (20.3%)</td>
<td>18 (17.0%)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>32 (50.0%)</td>
<td>55 (51.2%)</td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>19 (29.7%)</td>
<td>33 (31.1%)</td>
<td>0.782</td>
</tr>
<tr>
<td>Work experience (years)</td>
<td>4.0 ± 3.5</td>
<td>4.4 ± 3.7</td>
<td>0.579</td>
</tr>
<tr>
<td>Weekly hours</td>
<td>33.6 ± 16.8</td>
<td>26.9 ± 17.4</td>
<td>0.028</td>
</tr>
<tr>
<td>Shift work</td>
<td>7 (11.0%)</td>
<td>9 (8.5%)</td>
<td>0.596</td>
</tr>
</tbody>
</table>

Data are presented as means ± standard deviation or numbers and percentages.

**Table 4. Burnout, job strain and job satisfaction of patients with female versus male infertility**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Female infertility (n = 64)</th>
<th>Controls (n = 106)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burnout</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burnout</td>
<td>3.3 ± 1.0</td>
<td>3.4 ± 0.9</td>
<td>0.528</td>
</tr>
<tr>
<td>Tension</td>
<td>3.3 ± 1.4</td>
<td>3.7 ± 1.4</td>
<td>0.241</td>
</tr>
<tr>
<td>Listlessness</td>
<td>2.6 ± 1.1</td>
<td>3.1 ± 1.2</td>
<td>0.013</td>
</tr>
<tr>
<td>Cognitive weariness</td>
<td>2.6 ± 1.3</td>
<td>2.7 ± 1.2</td>
<td>0.679</td>
</tr>
<tr>
<td>Job strain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job demands</td>
<td>1.1 ± 0.8</td>
<td>1.2 ± 0.7</td>
<td>0.371</td>
</tr>
<tr>
<td>Personal schedule freedom</td>
<td>1.7 ± 1.0</td>
<td>1.7 ± 1.0</td>
<td>0.981</td>
</tr>
<tr>
<td>Intellectual discretion</td>
<td>16.9 ± 5.0</td>
<td>17.9 ± 4.8</td>
<td>0.552</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>3.9 ± 0.9</td>
<td>3.8 ± 1.1</td>
<td>0.656</td>
</tr>
</tbody>
</table>

**Discussion**

The present study found patients admitted on account of female infertility to have lower listlessness scores than patients admitted due to their partner’s reproductive dysfunction. Our first hypothesis was that patients feeling ‘guilty’ for the infertility status would have higher burnout scores. Indeed, a previous analysis performed by our group compared male patients admitted due to their infertility and male patients admitted due to female infertility in order to investigate the influence of working conditions and psychological stress on male reproduction [21]. Male infertility was acknowledged to be related to higher burnout as compared with patients admitted due to their partner’s reproductive impairment. In this study, the opposite was found to be true, as demonstrated by the trend of female patients towards lower marks in the burnout scores. It may be that the burden of reproductive failure falls most heavily on the female, whatever the reason for that failure.

Several studies have investigated gender differences in psychosocial responses of couples in treatment for infertility. In general, men were found to be less motivated than their partners towards fertility treatments [4,9]. Stoleru et al. [4] concluded that in women, stress factors reflected reactive changes to infertility, whereas in men, stress and sexual problems represented aetiological factors. It is possible that among the male population, occupational stress serves as an aetiological factor, while in women it might be a consequence of their infertility status.

It is unclear whether the impact of sporting activity and prolonged working hours on female infertility is ‘the chicken or the egg’, that is to say that women who feel ‘guilty’ regarding their infertility status may tend to search for some type of personal compensation such as increased involvement in physical and working activities. It may be suggested that the social responsibility for the conception and care rests much more upon the shoulders of women than men and, hence, it is possible that as a defence mechanism they tend to participate more in sporting and work activities. On the other hand, it is possible that choosing a career delays conception and therefore recognition of their infertility only occurs at a more advanced age.

Within the past few decades, a new and far-reaching phenomenon has been observed in which an increasing number of women start a family relatively late in their reproductive lives. Today, this delay in childbearing is socially accepted and relates primarily to increased opportunities for education, career choices and effective birth control measures [22–24]. However, advanced age is a well-known risk factor for infertility [24,25]. Moreover, the success rates of elderly women in programmes of assisted reproductive techniques are relatively low in comparison with their younger counterparts [26]. Thus, our finding of significantly advanced maternal age in the study group is not surprising.

Kushnir and Melamed [16] examined the impact of the Gulf War on burnout and well-being of working civilians and concluded that the estimation of work stress cannot be completely separated from other life events. Accordingly, the reduced listlessness scores of patients admitted due to female infertility might be a consequence of their physical activity. It is noteworthy that the ability of patients with female infertility problems to participate in sport and prolonged working hours is not because they did not have children at home, since there were no significant differences between the groups regarding previous children. In addition, although participation in strenuous endurance sports is a well-known risk factor for reproductive dysfunction [27], none of our patients were recognized as professional athletes. Thus, active
participation in sport activity may not be counted as a factor for inducing infertility.

A major limitation of our study is its small size and the homogeneity of occupations. One major drawback was our inability to assess the effect of occupational exposures to reproductive toxic agents on female infertility. It is possible that in a larger cohort, the non-significant trend we found between patients working as caretakers would have been found to be statistically significant. This issue should be evaluated in larger prospective studies, while in addition investigating the possible influence of antibodies from infectious diseases, which might be indigenous in preschool populations.

In conclusion, patients admitted due to female infertility tended to have lower listlessness scores as compared with patients admitted due to their partner's infertility. No significant association was found between other burnout, job strain and job satisfaction scores and female fertility status. Our findings suggest gender differences in dealing with infertility. Further prospective studies, including a higher number of participants, should investigate the effect of occupational stress on female infertility as well as gender differences.

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References