Research Paper

The Characteristics of Job-related Stress Factors and Ego States in Female Researchers at an Academic Institution

Yu Sakagami*, Masahiko Ando, Kosuke Tsurumi,
Teruhisa Uwatoko, and Taketomo Minoshima

Abstract

In recent decades, women have advanced in many areas of scientific research. However, it is still perceived as a male-dominated field. Some studies have reported that stress reactions vary according to job type, sex, and personality. This study analyzes job-related stress and ego states in female researchers, using the Brief Job Stress Questionnaire (BJSQ) and the Todai-shiki Ego gram (TEG). The BJSQ revealed that quantitative and qualitative workload caused significantly higher stress levels in female researchers than in other female employees at the institution. Physical complaints and lack of family/friend support caused significantly higher stress levels in female researchers than in male researchers. The TEG revealed that female researchers had significantly higher scores for critical parent and adult ego states than the other female employees. For high-stress female researchers, scores for the nurturing parent ego state were associated with significantly lower stress levels than those for low-stress female researchers. This study demonstrated that scores for job-related stress and ego states in female researchers are inherent aspects of their occupation. Occupational health physicians and psychiatrists should help female researchers cope with job stress on the basis of these characteristic ego states.

【Keywords】 job stress, mental health, gender, ego gram, scientific researcher

1. Introduction

According to the 2007 Japanese Ministry of Health, Labour and Welfare report on employee health, approximately 60% of Japanese employees experience high levels of job stress. [26] Of the approximately 30,000 annual cases of suicide reported since 1998 in Japan, [13] approximately 9,000 annual cases include employees. [13],[12],[25] Among these 9,000 suicides, approximately 2,500 [13], [12] were due to job stress. Thus, the reduction of job-related stress is a matter of great urgency in Japan.

* Corresponding author: Y. Sakagami
E-mail address: sakagami.yu.5s@kyoto-u.ac.jp

Some studies have reported that stress reactions vary according to job type and sex. [3], [4] Kato et al. reported that females experience higher job stress than males, and that psychological distress was associated with physical overload, lack of job suitability, and insufficient supervisor or coworker support. [7] Furthermore, Fukui et al. reported that job-related stress differs depending on occupation. [6] Parekh et al. found a significant association between stress level and ego state, summarizing the characteristics of various ego states and appropriate measures for dealing with stress. [16]

Scientific research has historically been pursued exclusively by men. Female researchers are still a minority. Under the rapid worldwide expansion and the women's advancement in science research, it is speculated that female researchers should have high levels of job stress and characteristic ego states. However, the preceding studies have not examined job stress and ego states for female researchers, as far as we know. [14], [19] In this study, we analyze job-related stress factors affecting female researchers and their ego states at one of the most prestigious research institutions in the world.

2. Methods

2.1 Study Participants

This study was conducted at an academic institution in Kobe, Japan that conducts research ranging from fundamental studies in biology to cutting-edge work in regenerative medicine. This institution belongs to Japan's largest basic scientific research organization and includes 30 laboratories and a research promotion division. In addition, it is part of the Japanese graduate school linking system, and its researchers supervise doctoral students of Kyoto University. Researchers at the institution conduct world-class studies with support from research technicians, office assistants, and administrative staff from the research promotion division.

We distributed the Brief Job Stress Questionnaire (BJSQ) [20] and the Todai-shiki Ego gram (TEG) [21], [18] to all employees at this institution as part of a periodic health check-up in July 2009. We initially focused only on female researchers because stress is known to differ between men and women. [17], [1] Next, we compared female researchers with male researchers. In addition, we analyzed the TEG scores of female researchers and compared them with the scores of other female employees at the institution. Our goal was to involve all 359 employees, including 40 female researchers, in the study. Informed consent was obtained from all participants, and the study was approved by the Occupational Health Committee of the institution.

2.2 BJSQ [20]

The BJSQ, a 57-item multidimensional job stress questionnaire with a 4-point Likert-type response scale (from 4 for "strongly agree" to 1 for "strongly disagree"), was used to assess job stress. The BJSQ focuses on stress reactions (psychological distress and physical complaints), job stressors, and social support. Psychological distress includes vigor, irritability, fatigue, anxiety,

and depression, and each of these elements comprise three questions. Physical complaints consist of one element comprising 11 questions. Job stressors include quantitative overload, qualitative overload, physical overload, interpersonal relationships, workplace environment, job control, skill discretion, job suitability, and job reward. Social support includes questions about supervisor, coworker, and family/friend support, and also surveys respondents' satisfaction with life.

In this study, we analyzed raw scores of the BJSQ. We also corrected for gender differences on the basis of deviation score. [20] Internal consistency, and factorial and criterion-related validity of job-related stress factors and symptom scales for the BJSQ have been demonstrated previously. [20]

2.3 TEG [21], [18]

The TEG, a 53-item multidimensional ego aptitude questionnaire using a 3-point Likert-type response scale, (from 2 for "agree" to 0 for "disagree") was used to assess ego state. The TEG, which is based on the transactional analysis theory by Dr. E. Berne, [2] focuses on the five ego states: 1) critical parent; 2) nurturing parent; 3) adult; 4) free child; and 5) adapted child. Analyzing the strength of these five states allows understanding of their characteristic tendencies. [21], [18] The critical parent ego state is characterized by criticism, severity, and perfectionism. The nurturing parent ego state is characterized by consideration, kindness, and tolerance. The adult ego state is characterized by rationalism, a businesslike attitude, and sane judgment. The free child ego state is characterized by creativity, unrestraint, and liveliness. The adapted child ego state is characterized by obedience, meekness, and passivity. [21], [18]

2.4 Statistical Analyses

Direction of raw scores was converted so that the stress level was directly indicated by the score level. The BJSQ and TEG scores of female researchers were compared with those of other female workers using the z-test. The BJSQ and TEG scores of the female researchers were compared with those of technicians and assistants by Steel's multiple comparison test, a non-parametric analog of Tukey's fixed range test. [23] The BJSQ and TEG scores of the female researchers were compared with those of male researchers using Student's t-test. Finally, the TEG scores were compared between the high- and low-stress female researchers using Mann–Whitney's U-test. In this study, we calculated total score for the BJSQ by combining the scores for physical complaints and psychological distress factors (vigor, irritability, fatigue, anxiety, and depression). All analyses were conducted using the JMP statistical software version 4 (SAS Institute, Tokyo, Japan) and Excel Statistics 2010 (SSRI Co., Ltd., Tokyo, Japan). The level of significance was set at 5%.

3. Results

3.1 Study Participants

We distributed both the BJSQ and the TEG to all 359 employees, including 40 female researchers, 151 male researchers, 92 female technicians, and 33 female assistants. Responses

were collected from 336 employees, including 40 female researchers, 146 male researchers, 86 female technicians, and 32 female assistants. Most respondents were Japanese. The overall response rate was 93.6%, and all female researchers responded. The overall mean age was 35.8 ± 7.1 years. The mean age was 37.4 ± 6.6 years for female researchers, 32.7 ± 6.2 years for female technicians, 35.4 ± 5.4 years for female assistants, and 37.2 ± 7.3 years for male researchers. The mean age of female researchers was significantly higher than that of female technicians ($p < 0.001$), whereas the difference in age between female researchers and female assistants or male researchers was not significant ($p = 0.162$, $p = 0.860$). Among the 40 female researchers, 20 belonged to high-stress group. Mean age for these respondents was 38.7 ± 5.9 years. The other 20 belonged to low-stress group, and their mean age was 36.2 ± 4.7 ($p = 0.11$).

3.2 Comparison of BJSQ Scores

3.2.1 Female Researchers and Female General Sample

Table 1 compares job stress between female researchers and Japanese female general sample. [20] For stress reactions, female researchers had significantly higher scores than female general sample for lack of vigor (8.1 ± 2.1 vs. 6.4 ± 2.3, $z = 4.88$). On the other hand, they had significantly lower scores than female general sample for irritability (5.3 ± 2.0 vs. 7.0 ± 2.2, $z = -5.37$), fatigue (6.3 ± 2.2 vs. 7.1 ± 2.5, $z = -2.29$), anxiety (5.4 ± 1.8 vs. 6.2 ± 2.3, $z = -2.81$), depression (8.9 ± 2.5 vs. 10.9 ± 3.9, $z = -5.05$), and physical complaints (18.0 ± 4.3 vs. 20.8 ± 5.7, $z = -4.11$). For job stressors, female researchers had significantly higher scores than female general sample for quantitative overload (9.1 ± 1.6 vs. 7.9 ± 2.2, $z = 4.74$) and qualitative overload (9.0 ± 1.5 vs. 8.0 ± 2.0, $z = 4.21$). On the other hand, female researchers had significantly lower scores than female general sample for interpersonal relationships (5.5 ± 1.3 vs. 6.3 ± 1.9, $z = -3.89$), workplace environment (1.8 ± 0.7 vs. 2.5 ± 1.0, $z = -6.32$), lack of job control (5.3 ± 1.3 vs. 7.2 ± 2.1, $z = -9.24$), insufficient skill discretion (1.5 ± 0.6 vs. 2.7 ± 0.9, $z = -12.65$), job suitability (1.7 ± 0.6 vs. 2.7 ± 0.8, $z = -10.54$), and lack of reward (1.6 ± 0.5 vs. 2.6 ± 0.9, $z = -12.65$). For social support, female researchers had significantly lower scores than female general sample for lack of coworker support (6.7 ± 1.9 vs. 8.2 ± 2.0, $z = -4.99$), lack of family/friend support (4.2 ± 1.5 vs. 10.3 ± 1.8, $z = -25.72$), and dissatisfaction with life (3.5 ± 1.0 vs. 5.5 ± 1.3, $z = -12.65$).

3.2.2 Female Researchers and Female Technicians

Table 2 compares job stress between female researchers and female technicians at the institution. No significant differences in psychological distress (vigor, irritability, fatigue, anxiety, and depressive mood) or physical complaints were found. For job stressors, female researchers had significantly higher scores than female technicians for quantitative overload (9.1 ± 1.6 vs. 7.3 ± 1.8, $p < 0.001$) and qualitative overload (9.0 ± 1.5 vs. 8.0 ± 1.8, $p < 0.01$). On the other hand, female researchers had significantly lower scores than female technicians for lack of job control (5.3 ± 1.3 vs. 6.1 ± 1.7, $p < 0.01$) and lack of reward (1.6 ± 0.5 vs. 1.9 ± 0.6, $p < 0.05$). No significant differences were found for social support between the two groups.

3.2.3 Female Researchers and Female Assistants

Table 2 compares job stress between female researchers and female assistants at the same institution. For stress reactions, female researchers had significantly higher scores than female assistants for fatigue (6.3 ± 2.2 vs. 5.3 ± 1.8, $p < 0.05$) and anxiety (5.4 ± 1.8 vs. 4.5 ± 1.7, $p < 0.05$). For job stressors, female researchers had significantly higher scores than female assistants for quantitative overload (9.1 ± 1.6 vs. 6.8 ± 2.2, $p < 0.001$), qualitative overload (9.0 ± 1.5 vs. 6.8 ± 1.9, $p < 0.001$), and physical overload (2.0 ± 0.8 vs. 1.4 ± 0.6, $p < 0.01$). In contrast, the score for insufficient skill discretion (1.5 ± 0.6 vs. 2.1 ± 0.8, $p < 0.01$) was significantly lower for female researchers than that for female assistants. No significant differences in social support were found between the two groups.

3.2.4 Female and Male Researchers

At first, the BJSQ raw scores were compared between female and male researchers. No significant differences were found for psychological distress. However, for physical complaints, female researchers had significantly higher scores than male researchers (18.0 ± 4.3 vs. 15.6 ± 3.6, $p < 0.001$). No significant differences were found between female and male researchers regarding job stressors. For social support, female researchers had significantly higher scores than male researchers for family/friend support (10.8 ± 1.5 vs. 9.9 ± 1.6, $p < 0.05$).

Next, in order to confirm our results, we compared the BJSQ scores after correction, which is calculated on the basis of deviation score for gender differences. [20] Table 3 compares job stress between female and male researchers as indicated by BJSQ scores after correction. No significant differences were found in psychological distress, but for physical complaints, female researchers had significantly higher scores than male researchers (2.9 ± 0.9 vs. 2.5 ± 0.7, $p < 0.01$). No significant differences were found between female and male researchers for job stressors. For social support, female researchers had significantly higher scores than male researchers for family/friend support (4.2 ± 0.9 vs. 3.6 ± 1.3, $p < 0.01$).

Table 1. Job stress for female researchers and general sample

	Researchers			General sample			z value
	n	Mean	S.D.	n	Mean	S.D.	
Stress reaction							
Lack of vigor (3–12)	40	8.1*	2.1	8447	6.4	2.3	4.88
Irritability (3–12)	40	5.3*	2.0	8447	7.0	2.4	5.37
Fatigue (3–12)	40	6.3*	2.2	8447	7.1	2.5	2.29
Anxiety (3–12)	40	5.4*	1.8	8447	6.2	2.3	2.81
Depression (6–24)	40	8.9*	2.5	8447	10.9	3.9	5.05
Physical complaints (11–44)	40	18.0*	4.3	8447	20.8	5.7	4.11
Job stressor							
Quantitative overload (3–12)	40	9.1*	1.6	8447	7.9	2.2	4.74
Qualitative overload (3–12)	40	9.0*	1.5	8447	8.0	2.0	4.21
Physical overload (1–4)	40	2.0	0.8	8447	2.0	1.0	0.00
Interpersonal relationships (3–12)	40	5.5*	1.3	8447	6.3	1.9	3.89
Workplace environment (1–4)	40	1.8*	0.7	8447	2.5	1.0	6.32
Lack of job control (3–12)	40	5.3*	1.3	8447	7.2	2.1	9.24
Insufficiency of skill discretion (1–4)	40	1.5*	0.6	8447	2.7	0.9	12.65
Job suitability (1–4)	40	1.7*	0.6	8447	2.7	0.8	10.54
Lack of job reward (1–4)	40	1.6*	0.5	8447	2.6	0.9	12.65
Social support							
Lack of supervisor support (3–12)	40	6.8	2.3	8447	6.6	2.1	0.55
Lack of coworker support (3–12)	40	6.7*	1.9	8447	8.2	2.0	4.99
Lack of family/friend support (3–12)	40	4.2*	1.5	8447	10.3	1.8	25.72
Dissatisfaction with life (2–8)	40	3.5*	1.0	8447	5.5	1.3	12.65

*$|z| > 1.96$ (female researchers vs. female general sample).
Numbers in parentheses indicate the range of scores.
Direction of raw scores is converted so that the stress level is directly indicated by the score level.
Underline indicates significantly more stressful state.

Table 2. Job stress for female researchers and other employees

	Researcher			Technician			Assistant		
	n	Mean	S.D.	n	Mean	S.D.	n	Mean	S.D.
Stress reactions									
Lack of vigor (3–12)	40	8.1	2.1	86	8.4	2.0	32	8.0	2.4
Irritability (3–12)	40	5.3	2.0	86	4.9	1.8	32	4.8	1.9
Fatigue (3–12)	40	6.3	2.2	86	5.9	2.1	32	5.3#	1.8
Anxiety (3–12)	40	5.4	1.8	86	4.8	2.0	32	4.5#	1.7
Depression (6–24)	40	8.9	2.5	86	9.1	3.4	32	8.5	2.9
Physical complaints (11–44)	40	18.0	4.3	86	17.3	5.3	32	17.3	4.1
Total stress reaction score (29–116)	40	52.0	10.6	86	50.5	12.9	32	48.4	10.7
Job stressors									
Quantitative overload (3–12)	40	9.1	1.6	86	7.3***	1.8	32	6.8###	2.2
Qualitative overload (3–12)	40	9.0	1.5	86	8.0**	1.8	32	6.8###	1.9
Physical overload (1–4)	40	2.0	0.8	86	2.0	0.7	32	1.4##	0.6
Interpersonal relationships (3–12)	40	5.5	1.3	86	5.3	1.5	32	4.9	1.6
Workplace environment (1–4)	40	1.8	0.7	86	2.0	0.8	32	1.8	0.8
Lack of job control (3–12)	40	5.3	1.3	86	6.1**	1.7	32	6.0	2.0
Insufficiency of skill discretion (1–4)	40	1.5	0.6	86	1.7	0.7	32	2.1##	0.8
Job suitability (1–4)	40	1.7	0.6	86	1.8	0.6	32	1.8	0.6
Lack of job reward (1–4)	40	1.6	0.5	86	1.9*	0.6	32	1.9	0.7
Social support									
Lack of supervisor support (3–12)	40	6.8	2.3	86	7.3	2.3	32	6.5	2.4
Lack of coworker support (3–12)	40	6.7	1.9	86	6.6	2.0	32	6.3	2.1
Lack of family/friend support (3–12)	40	4.2	1.5	86	4.7	2.0	32	4.0	1.5
Dissatisfaction with life (2–8)	40	3.5	1.0	86	3.5	1.1	32	3.5	1.0

*p < 0.05, **p < 0.01, ***p < 0.001 (researchers vs. technicians).
#p < 0.05, ##p < 0.01, ###p < 0.001 (researchers vs. assistants).
Numbers in parentheses indicate the range of scores.
Direction of raw scores is converted so that the stress level is directly indicated by the score level.
Underline indicates significantly more stressful state.

Table 3. Job stress for female and male researchers after correction

	Female researchers			Male researchers		
	n	Mean	S.D.	n	Mean	S.D.
Stress reactions						
Lack of vigor (1–5)	40	3.2	1.1	146	3.3	1.1
Irritability (1–5)	40	2.4	1.1	146	2.6	1.1
Fatigue (1–5)	40	2.9	1.0	146	3.0	0.8
Anxiety (1–5)	40	2.7	1.0	146	2.9	0.9
Depression (1–5)	40	2.4	0.8	146	2.5	1.1
Physical complaints (1–5)	40	2.9**	0.9	146	2.5	0.7
Total stress reaction score (5–30)	40	16.5	3.5	146	16.7	3.1
Job stressors						
Quantitative overload (1–5)	40	3.3	0.8	146	3.3	1.0
Qualitative overload (1–5)	40	3.3	0.8	146	3.4	0.9
Physical overload (1–5)	40	3.0	0.7	146	3.0	0.8
Interpersonal relationships (1–5)	40	2.6	0.6	146	2.6	0.9
Workplace environment (1–5)	40	2.6	0.9	146	2.8	0.9
Lack of job control (1–5)	40	4.2	0.7	146	4.2	0.8
Insufficiency of skill discretion (1–5)	40	3.5	0.6	146	3.6	0.7
Job suitability (1–5)	40	3.6	1.0	146	3.6	1.0
Lack of job reward (1–5)	40	3.8	1.0	146	3.7	1.1
Social support						
Lack of supervisor support (1–5)	40	3.4	1.1	146	3.2	1.1
Lack of coworker support (1–5)	40	2.9	1.0	146	3.0	1.0
Lack of family/friend support (1–5)	40	4.2**	0.9	146	3.6	1.3
Dissatisfaction with life (1–5)	40	3.7	0.8	146	3.6	0.9

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (female researchers vs. male researchers).
Numbers in parentheses indicate the range of scores.
Direction of raw scores is converted so that the stress level is indicated by the score level.
Underline indicates significantly more stressful state.

3.3 Comparison of TEG Scores

3.3.1 Female Researchers and Female General Sample

Table 4 compares ego states between female researchers and Japanese female general sample. [21], [18] Female researchers had significantly higher scores than female general sample for critical parent ego (14.0 ± 3.7 vs. 12.2 ± 4.2, z = 3.0) and adult ego (14.3 ± 4.2 vs. 10.9 ± 4.7, z = 5.3) states. On the other hand, female researchers had significantly lower scores than female general sample for the adapted child ego state (8.6 ± 4.8 vs. 11.7 ± 5.2, z = − 4.1).

Table 4. TEG scores for of female researchers and female general sample

	Researcher			General sample			z value
	n	Mean	S.D.	n	Mean	S.D.	
Critical parent (0–20)	40	14.0*	3.7	529	12.2	4.2	3.0
Nurturing parent (0–20)	40	13.8	4.4	529	14.3	4.3	−0.7
Adult (0–20)	40	14.3*	4.2	529	10.9	4.7	5.3
Free child (0–20)	40	13.2	4.9	529	13.3	4.2	−0.1
Adapted child (0–20)	40	8.6*	4.8	529	11.7	5.2	−4.1

*|z| > 1.96 (female researchers vs. general sample)
Numbers in parentheses indicate the range of scores.

3.3.2 Female Researchers and Female Technicians

Table 5 compares the ego states between female researchers and female technicians at the same institution. Female researchers had significantly higher scores than female technicians for critical parent (14.0 ± 3.7 vs. 10.9 ± 4.3, $p < 0.01$), adult (14.3 ± 4.2 vs. 11.8 ± 4.7, $p < 0.01$), and free child (13.2 ± 4.9 vs. 11.3 ± 4.7, $p < 0.05$) ego states. No significant differences were found between female researchers and female technicians in the nurturing parent and adapted child ego states.

3.3.3 Female Researchers and Female Assistants

Table 5 compares ego states between female researchers and female assistants at the same institution. Female researchers had significantly higher scores than female assistants for the critical parent (14.0 ± 3.7 vs. 11.1 ± 3.8, $p < 0.01$) and adult (14.3 ± 4.2 vs. 10.8 ± 4.0, $p < 0.01$) ego states. No significant differences were found in the other three ego states between female researchers and female assistants.

Table 5. Ego states in female researchers and other employees

	Researcher			Technician			Assistant		
	n	Mean	S.D.	n	Mean	S.D.	n	Mean	S.D.
Critical parent (0–20)	40	14.0	3.7	86	10.9**	4.3	32	11.1##	3.8
Nurturing parent (0–20)	40	13.8	4.4	86	12.8	4.9	32	14.9	4.8
Adult (0–20)	40	14.3	4.2	86	11.8**	4.7	32	10.8##	4.0
Free child (0–20)	40	13.2	4.9	86	11.3*	5.2	32	13.7	4.6
Adapted child (0–20)	40	8.6	4.8	86	10.4	5.4	32	9.0	5.6

*p < 0.05, **p < 0.01, ***p < 0.001 (researcher vs. technicians).
#p < 0.05, ##p < 0.01, ###p < 0.001 (researchers vs. assistants).
Numbers in parentheses indicate the range of scores.

3.3.4 Female and Male Researchers

No significant differences were found in any of the five ego states between female and male researchers.

3.3.5 High- and Low-stress Female Researchers

Finally, we compared TEG scores between high- and low-stress female researchers identified by BJSQ (Table 6). For the nurturing ego state, high-stress female researchers had significantly lower scores than low-stress female researchers (11.2 ± 3.9 vs. 16.3 ± 3.9, $p < 0.01$). No significant differences were found for the other ego states between the two groups.

Table 6. Ego states in high- and low-stress female researchers

	High-stress researchers			Low-stress researchers		
	n	Mean	S.D.	n	Mean	S.D.
Critical parent (0–20)	20	14.2	3.9	20	13.8	3.6
Nurturing parent (0–20)	20	11.2**	3.9	20	16.3	3.5
Adult (0–20)	20	13.6	4.3	20	15.1	4.1
Free child (0–20)	20	12.2	4.6	20	14.3	5.0
Adapted child (0–20)	20	9.9	4.8	20	7.3	4.6

*p < 0.05, **p < 0.01, ***p < 0.001 (high-stress female researchers vs. low-stress female researchers).
Numbers in parentheses indicate the range of scores.

4. Discussion

4.1 Job-related Stress Factors for Female Researchers

4.1.1 Quantitative and Qualitative Overload

To our knowledge, this is the first study that compares the job-related stress factors for female researchers with that for other employees at the same institution. In this study, female researchers showed high levels of job stress. In particular, they had higher levels of quantitative and qualitative overload than other female employees (Tables 1, 2). However, no significant differences were found between female and male researchers for these factors (Table 3).

Sakagami et al. [19] compared BJSQ scores between male researchers and other male employees in an academic institution, and reported that male researchers had significantly higher levels of quantitative and qualitative overload. They also reported that among male researchers, supervisors had the highest level of qualitative workload. [19] Furthermore, they indicated that among male researchers, quantitative overload was associated with psychological distress and that qualitative overload was significantly associated with physical complaints.[19] Thus, based on the results of our study, we suggest that both male and female researchers experience more quantitative and qualitative overload than other same gender employees at the same institution.

In another related study, Shoji et al. reported that the job stress for software engineers was derived only from high quantitative workload. [22] Fukui et al. found an association between quantitative overload and psychological distress in their study on job stress in engineers working in the information technology industry. [6] These results suggest that job stress for engineers may be somewhat similar to that for researchers. Certainly, for most researchers, the problem they face seems to be the workload necessary to fulfill their duties within the required time frame. This emerged as a significant stressor in our study.

In this study, female researchers reported a far higher qualitative workload than other female employees. Because their work is more academic in nature than that for other employees, their job requires both novelty and originality, although they do not have the stress involved with pursuing profit or serving customers.[5] They engage in serious intellectual competition to obtain study funds and higher research positions. These qualitative factors are the most essential elements of their work. This study demonstrated that female researchers at our institution experience more quantitative and qualitative overload than other female employees.

4.1.2 Sex Differences in Job-related Stress Factors

Scientific research has historically been pursued by men. Today, it is still perceived as a male-dominated field. Our investigation revealed a gender gap between female and male researchers in terms of workload. As anticipated, raw score analysis revealed that female researchers had significantly higher scores than male researchers for physical complaints (18.0 ± 4.3 vs. 15.6 ± 3.6, $p < 0.001$) and lack of family/friend support (10.8 ± 1.5 vs. 9.9 ± 1.6, $p < 0.05$). In some previous studies, higher stress levels were reported for these factors in female workers than in male workers. [3], [4], [7] In our additional analysis of non-research employees of

both sexes at our institution [20] (data not shown), female employees scored significantly higher than male employees for physical complaints (20.8 ± 5.7 vs. 18.2 ± 5.2, z = 41.92) and lack of family/friend support (10.3 ± 1.8 vs. 9.9 ± 2.0, z = 20.42). We compared the BJSQ scores after correction, which is calculated on the basis of deviation score for gender differences. Scores for these two job-related factors were still higher for female researchers than for male researchers even after correction. Thus, the differences must be due to occupation. In other words, the gender gap for physical distress and family/friend support is more pronounced in the field of scientific research than in other occupations at the same institution.

Nomura et al. observed an association between somatic symptoms and job stress, and investigated active coping behaviors among Japanese employees. [15] Nomura et al. suggested that health guidance about active coping could be used to alleviate physical complaints induced by job stress.[15], [11] In addition, the results of other studies indicate that more social support from family/friends is needed for female researchers. [8], [10]

4.2 Ego States in Female Researchers

To our knowledge, this is the first study comparing the ego states of female researchers with those of other employees.[16] In this study, on average, female researchers were characterized by a adult dominant ego type and scored significantly higher for both critical parent and adult ego states compared with other female employees (Tables 4, 5). They also scored higher for the free child ego state than for the adapted child ego state (Tables 4, 5).

Shinzato et al. reported on a very similar ego state type. [21] They commented that people with this ego type are rationalists who work with great efficiency, are very critical, tend to find faults with others, and are clear-headed but self-centered. We speculate that these ego state tendencies are essential for performing scientific research, since these characteristics were found to be common to both female and male researchers in this study. In addition, male researchers had significantly higher scores for critical parent and adult ego states than other male employees (data not shown). Skills characteristic of the critical parent ego state may be needed to assess experimental results and draw sound conclusions. In addition, skills characteristic of the adult ego state may be suitable to the occupation of scientific researcher, which calls for rational and cool judgment. The child ego state may also be suitable to this occupation, as novelty, originality, free thinking, and unfettered inspiration are essential for world-class research.

4.3 Job-related Stress Factors and Ego State in Female Researchers

In this study, high-stress female researchers had significantly lower scores for the nurturing parent ego state than low-stress female researchers. Shinzato et al. reported that most of the good-adapted women in Japan were nurturing parent-dominant ego type and M-shaped ego gram which were high for the nurturing parent and free child ego states, low for the critical parent and adapted child ego states, and intermediate for the adult ego state. [21] Based on their results, they commented that women of this type have good mental health and orient themselves toward their communities. Thus, we speculated that the low scores in our study for the nurturing parent

ego state are related to high-stress reactions. In terms of health guidance, occupational health physicians and psychiatrists should advise these workers to promote their nurturing ego state for their own mental health. [16], [24]

4.4 Limitations

The results of this study may not necessarily represent job-related stress factors for all female researchers because this study was performed at a single institution. Secondly, we cannot discuss the causal relationships between job-related stress factors and ego state because of the cross-sectional design of the study. Hence follow-up studies are required. Thirdly, perceived overload, coping style, marital status, and ego-defense aptitude were not investigated in this study. Structured interviews including these elements should be conducted by specialists in future studies.[9] For health promotion purposes, it is important to determine the positive and negative influences of intellectual and creative work on female employees.

5. Conclusions

In this study, quantitative and qualitative workload was the most significant job-related stress factor among female researchers at a single academic institution. Female researchers reported more physical complaints than male researchers in this study. In addition, the results suggest that more social support from family/friends is needed for female researchers. [10] In this study, the critical parent and adult ego states were prominent among female researchers. Furthermore, the low scores for the nurturing parent ego state were found to be related to stress reactions. In summary, the results of this study suggest that occupational health physicians and psychiatrists should guide female scientific researchers to promote their mental health on the basis of the characteristics of job-related stress factors and ego states.

References

(1) Ahola, K., Honkonen, T., Lonnqvist, J., et al. (2006). Contribution of burnout to the association between job strain and depression: the health 2000 study. J Occup Environ Med, 48, 1023-1030.
(2) Berne, E. (1961). Transactional analysis in psychotherapy: A systematic individual and social psychiatry. New York, US: Grove Press.
(3) Department of Mental Health and Substance Dependence. (2000). Depression in women. Women's mental health, an evidence based review. Mental health determinants and populations. Geneva: World Health Organization, 31-46.
(4) Doi, Y., & Minowa, M. (2003). Gender differences in excessive daytime sleepiness among Japanese workers. Social Science & Medicine, 56, 883–894.
(5) Fujigaki, Y., & Kosugo, R. (1992). Workload in software development work. Jpn J Ind Health, 34, 116-125, (in Japanese).
(6) Fukui, R., Haratani, T., Fujioka, Y., et al. (2003). Stress reactions and their correlates factors of engineers working in the information technology industry: using the brief job stress questionnaire. Job Stress Research, 10, 273-279, (in Japanese).

(7) Kato, S., Doi, Y., Makino, M., et al. (2004). Job Stress among Japan Overseas Cooperation Volunteers: Using the Brief Job Stress Questionnaire. Job Stress Research, 46, 191-200, (in Japanese).
(8) Kawakami, N., & Haratani, T. (1999). Epidemiology of job stress and health in Japan: review of current evidence and future direction. Ind Health, 37, 174-186.
(9) Kawano, Y. (2008). Association of Job-related Stress Factors with Psychological and Somatic Symptoms among Japanese Hospital Nurses: Effect of Departmental Environment in Acute Care Hospitals. J Occup Health, 50, 79-85.
(10) Kishi, R., Titahara, A., Masuchi., et al. (2002). Work-related reproductive, musculoskeletal and mental disorders among working women-history, current issues and future research directions. Ind Health, 40, 101-112.
(11) Lambert, V. A., Lambert, C. E., & Ito, M. (2004). Workplace stressors, ways of coping and demographic characteristics as predictors of physical and mental health of Japanese hospital nurses. Int J Nurs Stud, 41, 85-97.
(12) Life security section. (2003). The number of the suicides according to sex / age / cause / motive. The summary document of the suicide in 2002, Tokyo: Japanese National Police Agency, 1-45, (in Japanese).
(13) Life security section. (2008). Statistics about the security of the life. The summary document of the suicide in 2007, Tokyo: Japanese National Police Agency, 1-25, (in Japanese).
(14) Nakao, M., & Yano, E. (2006). A comparative study of behavioural, physical and mental health status between term-limited and tenure-tracking employees in a population of Japanese male researchers. Public Health, 120, 373-379.
(15) Nomura, K., Nakao, M., Yano, E., et al. (2007). The Association of the Reporting of Somatic Symptoms with Job Stress and Active Coping among Japanese White-collar Workers. J Occup Health, 49, 370-375.
(16) Parekh MA, Majeed H, Khan TR, et al. (2010). Ego defense mechanisms in Pakistani medical students: a cross sectional analysis. BMC Psychiatry, 29, 10-12.
(17) Plaisier, I., de Bruijn, J. G., & Penninx, B. W. (2007). The contribution of working conditions and social support to the onset of depressive and anxiety disorders among male and female employees. Soc Sci Med, 64, 401-410.
(18) Psychosomatic medicine, University of Tokyo. (2009). TEG Ⅱ. Tokyo, Japan: Kaneko Press.
(19) Sakagami, Y., Ando, M., Kawamura, T. (2011). Association of job-related factors with stress reactions among male researchers at a Japanese academic institution. Stress Science Research, 26, 61-67.
(20) Shimomitsu, T., Yokoyama, K., Tanigawa, T., et al. (2000). Manual of the Brief Job Stress Questionnaire. Reports on the study of job stress and its effects on health in the workplace: The research grant for the prevention of work-related diseases from the Japan Ministry of labour. Tokyo: The Ministry of Labor, 17-135, (in Japanese).
(21) Shinzato, R., Mizuno, M., Katsura, T., et al. (2007). Transactional analysis series, 3, Tokyo, Japan: Team-Iryo.
(22) Shoji, M., Satoh, S., Imai, Y., et al. (1990). Mental health in software engineers II. Jpn J Ind Health, 32, 258-264, (in Japanese).
(23) Steavens, J. (1989). A nonparametric Multiple Comparison Test for Differences in Scale Parameters. Metrika, 36, 91-106.
(24) Tyler, P., & Cushway, D. (1992). Stress, coping and mental well-being in hospital nurses. Stress Med, 8, 91-98.
(25) Wage, welfare, and statistics section. (1998). Reports of worker's health investigation in 1997,

Tokyo: Ministry of Labour, 1-30, (in Japanese).
(26) Wage, welfare, and statistics section. (2008), Reports of worker's health investigation in 2007. Tokyo: Ministry of Health, Labour and Welfare, 1-50, (in Japanese).

Acknowledgements

The authors would like to express our deep gratitude to Professor Toshiya Murai, Department of Psychiatry, Graduate School of Medicine, Kyoto University.

(Associate Professor, The International Center, Kyoto University)
(Associate Professor, Kyoto University Health Service)
(Graduate Student, Department of Psychiatry, Graduate School of Medicine, Kyoto University)
(Assistant Professor, Kyoto University Health Service)
(Executive Vice President, Kyoto Iwakura Hospital)

女性研究者の職業性ストレスと自我態度の特徴

阪上優、安藤昌彦、鶴身孝介、上床輝久、蓑島豪智

要旨

近年、女性の科学分野への進出は著しい。しかしながら、科学研究は、未だ男性優位の職域である。職業性ストレスは、職種、性別、及びパーソナリティによって異なることが、先行研究によって知られている。女性研究者は、特有のストレスに暴露されていると推測されるが、予防医学的研究はほとんどなされていない。我々は、女性研究者の健康管理のために、Brief Job Stress Questionnaire (BJSQ) と Todai-shiki Ego-gram(TEG) を用いて、職業性ストレスと自我態度の特徴を明らかにしようと試みた。BJSQ では、女性研究者は他の職種と比較して、量的労働負荷と質的労働負荷が有意に高かった。男女間で比較してみると、女性研究者は、身体的ストレス反応が有意に高かった。また、男性研究者に比し、家族や友人のサポートの不足をより強く感じていた。自我態度においては、critical parent と adult の自我態度の得点が、一般成人女性よりも有意に高かった。さらに、女性研究者を高ストレス群と低ストレス群に分けて、自我態度を比較してみると、高ストレス群では、nurturing parent の自我態度が有意に低かった。以上より、女性研究者は、特徴的な職業性ストレスと自我態度を有していることが示唆された。産業医や精神科医は、これらの特徴を踏まえながら、女性研究者に対してより適切な医学的助言を行うことが望ましいと考えられる。

（京都大学国際交流推進機構国際交流センター・准教授）
（京都大学環境安全保健機構健康科学センター・准教授）
（京都大学大学院医学研究科脳病態生理学講座精神医学教室・大学院生）
（京都大学環境安全保健機構健康科学センター・助教）
（京都岩倉病院・副院長）