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Short Communication

Giving social support at work may reduce inflammation on employees themselves: a participatory workplace intervention study among Japanese hospital nurses

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Abstract: Previously, we reported that the participatory workplace intervention was effective in reducing stress-related inflammatory markers among 31 Japanese female nurses. During the analysis, we recognized that our intervention might have increased prosocial behaviors like giving social support to others in some participants. Based on this assumption, we ran a secondary analysis, which examined the effect of giving social support on inflammatory markers, autonomic nervous activity (ANA), and perceived job stress (PJS) before and after the intervention. A group of participants who had increased scores on giving social support (n=13) showed significant decreases in interferon-γ, interleukin-6, and interleukin-12/23p40 after the intervention. Another group of those who had decreased/unchanged in the scores (n=17) did not show changes in these markers. Regarding ANA and PJS, no significant changes were observed in both groups. This study presented insight that giving social support at work may provide health benefits towards employees themselves, via decreasing inflammation.

Key words: Giving social support, Inflammatory markers, Autonomic nervous activity, Job stress, Participatory workplace intervention, Hospital nurses

Organizational-level participatory workplace intervention, which aims to improve work environment and employees' health, is more likely to produce sustainable effects than interventions targeting an individual because employees take an active part in identifying problems and

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giving possible solutions by themselves[1]. In our previous study, we reported that a 5-month lasting organizational-level participatory workplace intervention was effective in reducing stress-related inflammatory markers as represented by interferon (IFN)-γ, interleukin (IL)-6, and IL-12/23p40, and IL-15 among 31 Japanese female nurses[2]. During this course, we recognized that our intervention might have stimulated prosocial helping behaviors like giving social support to others in some participants. Based on this assumption, we decided to run a secondary analysis focusing on giving social support and physiological responses.

It is well documented that social support acts as a stress buffer, which contributes to improving mental and physical health[3]. With regard to physiological markers, a number of studies reported the existence of positive associations between receiving/perceived social support and inflammatory markers and autonomic nervous activities (ANA)[4–6]. These studies mainly focused on receiving social support at work rather than giving social support. There is a lack of evidence on the effects of giving social support on physiological outcomes. Although limited studies on giving social support, two intervention studies examined the effects of giving social support on physiological responses (inflammatory markers, heart rate, blood pressure, salivary alpha-amylase, and salivary cortisol) among healthy individuals[7, 8]. These studies revealed that giving social support contributed to decreasing inflammatory markers, systolic blood pressure, and salivary alpha-amylase[7, 8]. However, the study settings were experimental, i.e., the procedure was to imagine someone whom participants wanted to support and write a supporting letter to him/her, etc. To the best of our knowledge, no organizational-level studies to date have examined giving social support and physiological outcomes in a work setting.

Therefore, the present study aimed to explore how changes in giving social support to others at work affected physiological responses among Japanese female nurses. We hypothesized that those who increased giving social support by the intervention would have a positive effect on inflammation and ANA; we would observe those who had increased scores on giving social support exerted decreased inflammatory markers and ANA to healthier status compared to those who had no change or decreased scores.

We carried out a participatory workplace improvement intervention[9–12] from August 2017 to February 2018. Briefly, the participatory workplace improvement intervention is that employees at the workplace actively take part in identifying workplace problems, find feasible actions/solutions, and work towards improvement (detailed procedure is presented in our previous paper[2]). We recruited nurses working at a hospital (n=144) in the southern part of Japan. A total of 36 nurses agreed to participate in this study. We conducted evaluations before the intervention for baseline (T1), within a week after the end of the intervention to assess immediate effects (T2), and 3 months after the end of the intervention to assess prolonged and lasting effects (T3). We excluded participants who became pregnant during the study period (n=1), missed evaluations (n=3), and had incomplete responses in giving social support questions (n=1). A male participant (n=1) was also excluded because of possible sex differences in physiological measures. Therefore, a total of 30 female nurses were submitted to the final analysis.

This study was reviewed and approved by the ethical committee of the International University of Health and Welfare (18-Im-002) and registered on the University Hospital Medical Information Network Clinical Trials Registry (UMIN000039836). We informed potential participants about the study aim, procedure, and confidentiality policy for individual information. Written informed consent was obtained from those who agreed to participate. After the evaluations, participants received a 1,000-yen gift card as a reward.

We used a self-administered questionnaire to assess participants' sociodemographic and job-related characteristics including social support at work and perceived psychosocial job stress. In the questionnaire, we internally developed questions of 'giving' social support to others at work, which we modified from 'receiving' social support in the Brief Job Stress Questionnaire[13]; "How much help do you provide to the following people?", "How much are you relied on by the following people?", "How well do you listen to the following people when you were asked for advice on personal matters?" Participants answered each question by superiors, co-workers, and subordinates with a four-point scale (1=extremely to 4=not at all) and we summed all scores. Validity was estimated by calculating the correlations between giving social support and other covariates including receiving social support, and the relationships were in the expected direction indicating a high convergent validity (data not shown). Cronbach's alphas for these items exceeded 0.784 at all-time points. In addition, using a dataset from our previous study including 176 white-collar workers, the stability of giving social support scores over one year (simple correlation coefficients) exceeded 0.580 (p<0.001, data not shown).

We measured serum interferon (IFN)-γ, interleukin (IL)-

6, tumor necrosis factor (TNF)-α, IL-12/23p40, IL-15, IL-27, and high-sensitivity C-reactive protein (hs-CRP) as inflammatory markers. These inflammatory markers were selected based on their association and non-association with social support[5, 14] as well as to explore novel candidate markers.

Blood samples were collected in gamma-ray sterilized polyethylene-terephthalate tubes containing serum separating gel and coagulation accelerant (silica particles) between 2 pm and 5 pm on the evaluation days. We stored the samples in a cooler box (0–5°C) and transported them to our laboratory twice a day by 4:30 pm and 7:30 pm. In the laboratory, we centrifugalized the samples with 2,400 rpm for 10 minutes to extract 500μL of the serum and deep-freezed (–20°C) until the analysis. The level of inflammatory markers was assessed with the Enzyme Immunoassay or Chemiluminescent Enzyme Immunoassay with MESOTM Quick-Plex SQ 120 (Meso Scale Diagnostic, LCC, Rockville, USA) by the analyzing company, Life Science Institute Medience Corporation, Japan. The minimum detectable level for IFN-γ, IL-6, TNF-α, IL-12/23p40, IL-15, IL-27, and hs-CRP was 0.2 pg/ml, 0.06 pg/ml, 0.04 pg/ml, 15.0 pg/ml, 2.0 pg/ml, 8 pg/ml, and 0.004 mg/dl, respectively. We calculated the values lower than them into the minimum detectable level/√2, as described elsewhere[15].

We utilized an electrocardiograph device, Silmee Bar Type Lite (Silmee; Tokyo Denki Kagaku, Tokyo, Japan) to measure heart rate variability (HRV). Silmee measures HRV and calculates 3 sympathetic nervous activity (SNA) parameters (low-frequency HRV/total frequency HRV (standing position), mean R-R interval/R-R interval per minute (standing position), and mean R-R interval (supine-stand position)) and 3 parasympathetic nervous activity (PNA) parameters (mean R-R interval (supine position), high-frequency HRV/total frequency HRV (supine position), and the standard deviation of R-R intervals (SDRR) (supine position)) by the power spectral analysis. It also calculates SNA/PNA ratio. We measured participants' ANA in the hospital between 2 pm and 5 pm to adjust in-day fluctuation.

Based on the total giving social support score at each time-point, we divided participants into two groups; those who had increased scores on giving social support to others after the intervention (Group 1, n=13), and those who had decreased/unchanged in the scores (Group 2, n=17). After the confirmation of non-Gaussian distribution with the Shapiro-Wilk test, we applied the Friedman test to examine changes in inflammatory markers, ANA, and perceived job stress by the group. We analyzed data using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Chicago, IL, USA). The level of significance was set at $p<0.05$.

Table 1 shows the baseline characteristics of female nurse participants. The median age of participants was 37.0 years old for Group 1 and 38.0 years old for Group 2. More than 60% of participants were not married in both groups. From department G (nursing department), only one nurse participated in this study. More than half of the participants worked for the day shift in both groups. Over 80% of participants had 6 or more hours of sleep on workdays in both groups. Most of them in both groups were under regular menstrual cycle (>76.5%). Only one participant in each group smoked. Participants in Group 2 (n=6) had more frequent use of medication (for allergy, high blood pressure, high cholesterol level, etc.) than those in Group 1 (n=2). About one-third of participants in both groups had diseases currently being treated (i.e., allergic rhinitis, uterine fibroids, high blood pressure, knee osteoarthritis).

Table 2 presents the changes of physiological markers over time in Group 1. IFN-γ (p=0.005), IL-6 (p=0.018), and IL-12/23p40 (p=0.018) were significantly decreased at T2 compared to T1. IL-12/23p40 was decreased at T3 compared to T1 (p=0.013). The overall changes of TNF-α were also significant (p=0.021), but it was insignificant with Bonferroni-adjusted pairwise tests. No significant decreases were found in ANA.

Table 3 shows the changes of physiological markers in Group 2 over time. Neither blood inflammatory markers nor ANA showed significant changes.

There were no significant decreases in perceived job stress over time in both groups (see Appendices 1 and 2).

This study examined the effect of giving social support to others on inflammatory markers, autonomic nervous activity, and perceived job stress before and after participatory workplace intervention among Japanese female nurses. As we hypothesized, the group with increased levels of giving social support (Group 1) showed significant post-intervention decreases in inflammatory markers (IFN-γ, IL-6, and IL-12/23p40), while another group with decreased/unchanged levels of giving social support (Group 2) did not show such changes. ANA and perceived job stress did not show significant changes in both groups. We believe that this is one of the first studies to examine changes in giving social support to others at work after an organizational-level intervention using multiple physiological markers.

We observed decreases in inflammatory markers only in Group 1. Our finding is comparable with a study regarding giving social support and inflammatory markers among healthy middle-aged women[8]. This study reported that in-

Table 1. Baseline characteristics of female nurse participants

	Group 1 (n=13)				Group 2 (n=17)				*p*-value
	n	%	Median	Interquartile range	n	%	Median	Interquartile range	
Age			37.0	23.0 – 43.0			38.0	26.0 – 43.0	0.536
Marriage status									
Single	10	76.9			11	64.7			
Married	2	15.4			6	35.3			
Divorced	1	7.7			0	0			
Number of years employed as a nurse			6.0	3.0 – 18.0			17.0	7.0 – 24.0	0.103
Number of participants by units and departments									
A (orthopaedics, gastrointestinal surgery, obstetrics and gynecology unit)	1	7.7			4	23.5			
B (rheumatology, diabetic tract medicine, pulmonary medicine, cardiovascular medicine, nephrology unit)	2	15.4			2	11.8			
C (gastrointestinal medicine, palliative care, hematology, oncology, urology unit)	5	38.5			1	5.9			
D (operation department)	1	7.7			3	17.6			
E (out-patient department)	2	15.4			3	17.6			
F (home nursing department)	2	15.4			3	17.6			
G (nursing department)	0	0			1	5.9			
Work shift									
Daytime	7	53.8			11	64.7			
2-Shifts	6	46.2			6	35.3			
Average sleep hours on work days			6.0	6.0 – 7.0			6.0	6.0 – 7.0	0.742
<6 hours	2	15.4			1	5.9			
≥6 hours	11	84.6			16	94.1			
Menstrual cycle									
Menstruation	1	7.7			2	11.8			
Follicular phase	2	15.4			5	29.4			
Luteal phase	8	61.5			6	35.3			
Menopause	2	15.4			2	11.8			
Other	0	0			1	5.9			
Not ascertained	0	0			1	5.9			
Smoking (number of cigarettes per day)			10				20		
Smokers	1	7.7			1	5.9			
Non-smokers	12	92.3			16	94.1			
Medication usage									
No	11	84.6			11	64.7			
Yes	2	15.4			6	35.3			
Diseases currently being treated									
No	8	61.5			10	58.8			
Yes	4	30.8			6	35.3			
Not ascertained	1	7.7			2	11.8			

Group 1: the group which increased scores on giving social support after the program; Group 2: the group which decreased/unchanged scores on giving social support after the program.

Table 2. Level of physiological markers in Group 1 over time (n=13)

	T1		T2		T3		*p*-value	*p*-value (pairwise) [a]
	Median	Interquartile range	Median	Interquartile range	Median	Interquartile range		
Blood inflammatory markers:								
IFN-γ (pg/ml)	2.96	(2.23 – 4.82)	2.15	(0.92 – 3.19)	2.68	(1.71 – 3.95)	0.007	T1 vs. T2: 0.005, T1 vs. T3: 0.350, T2 vs. T3: 0.350
IL-6 (pg/ml)	0.515	(0.328 – 1.070)	0.363	(0.238 – 0.919)	0.437	(0.327 – 0.933)	0.018	T1 vs. T2: 0.018, T1 vs. T3: 1.000, T2 vs. T3: 0.150
TNF-α (pg/ml)	1.59	(1.33 – 2.06)	1.42	(1.18 – 1.63)	1.33	(1.16 – 1.61)	0.021	T1 vs. T2: 0.056, T1 vs. T3: 0.056, T2 vs. T3: 1.000
IL-12/23p40 (pg/ml)	136.0	(93.10 – 161.50)	118.0	(78.70 – 131.50)	116.0	(81.05 – 141.50)	0.005	T1 vs. T2: 0.018, T1 vs. T3: 0.013, T2 vs. T3: 1.000
IL-15 (pg/ml)	2.64	(2.28 – 2.97)	2.45	(2.22 – 2.98)	2.45	(2.28 – 2.76)	0.397	
IL-27 (pg/ml)	1,020	(944.5 – 1,315.0)	1,040	(894.5 – 1,240.0)	1,140	(820.0 – 1,480.0)	0.397	
hs-CRP (mg/dl)	0.011	(0.007 – 0.081)	0.100	(0.005 – 0.072)	0.013	(0.008 – 0.095)	0.192	
Autonomic nervous activities:								
Low frequency/total frequency (standing)	0.749	(0.640 – 0.827)	0.713	(0.638 – 0.81)	0.763	(0.638 – 0.87)	0.794	
Mean R-R interval/ R-R interval per minutes (standing)	233.2	(194.4 – 283.9)	245.7	(176.5 – 261.3)	225.9	(188.4 – 280.2)	0.926	
Mean R-R interval (supine-standing)	167.3	(117.4 – 207.7)	180.4	(140.1 – 214.0)	154.6	(116.4 – 192.4)	0.794	
Mean R-R interval (supine)	840.3	(771.4 – 943.5)	803.4	(709.2 – 918.3)	835.4	(750.1 – 895.9)	0.794	
High frequency/total frequency (supine)	0.590	(0.450 – 0.779)	0.604	(0.391 – 0.781)	0.681	(0.422 – 0.804)	0.794	
SDRR (supine)	30.8	(22.5 – 41.5)	30.0	(18.8 – 40.6)	33.7	(21.1 – 39.3)	0.926	
Sympathetic/parasympathetic nervous activity ratio	1.172	(0.920 – 1.326)	1.080	(0.952 – 1.470)	1.113	(0.821 – 1.356)	0.232	

[a] Bonferroni test.

Group 1: the group which increased scores on giving social support after the program; T1: baseline (before the program); T2: immediately after the program; T3: 3 months after the program; IFN: interferon; IL: interleukin; TNF: tumor necrosis factor; hs-CRP: high-sensitivity C-reactive protein; SDRR: standard deviation of R-R intervals.

Table 3. Level of biomarker in Group 2 over time (n=17)

	T1		T2		T3		*p*-value
	Median	Interquartile range	Median	Interquartile range	Median	Interquartile range	
Blood inflammatory markers:							
IFN-γ (pg/ml)	2.56	(1.87 – 4.94)	2.18	(1.54 – 4.03)	2.76	(1.95 – 3.95)	0.368
IL-6 (pg/ml)	0.318	(0.224 – 0.533)	0.327	(0.252 – 0.509)	0.347	(0.183 – 0.489)	0.291
TNF-α (pg/ml)	1.46	(1.25 – 1.69)	1.42	(1.07 – 1.68)	1.46	(1.21 – 1.71)	0.291
IL-12/23p40 (pg/ml)	121.0	(100.9 – 152.5)	99.6	(84.0 – 121.0)	115.0	(87.7 – 144.0)	0.120
IL-15 (pg/ml)	2.78	(2.56 – 3.07)	2.85	(2.52 – 3.28)	2.66	(2.38 – 3.04)	0.101
IL-27 (pg/ml)	1,100	(885.0 – 1,260.0)	962	(840.0 – 1,185.0)	1,090	(930.5 – 1,375.0)	0.193
hs-CRP (mg/dl)	0.014	(0.007 – 0.480)	0.170	(0.006 – 0.032)	0.013	(0.008 – 0.035)	0.701
Autonomic nervous activities:							
Low frequency/total frequency (standing)	0.694	(0.591 – 0.751)	0.749	(0.668 – 0.813)	0.764	(0.591 – 0.821)	0.059
Mean R-R interval/ R-R interval per minutes (standing)	205.1	(140.3 – 262.7)	228.1	(174.4 – 259.2)	225.4	(167.3 – 252.9)	0.465
Mean R-R interval (supine-standing)a	127.1	(85.8 – 180.9)	135.5	(114.5 – 185.8)	140.0	(95.3 – 198.2)	0.662
Mean R-R interval (supine)	869.3	(762.0 – 924.1)	859.2	(763.0 – 916.0)	865.2	(776.8 – 901.7)	0.790
High frequency/total frequency (supine)	0.659	(0.583 – 0.709)	0.660	(0.538 – 0.781)	0.687	(0.609 – 0.739)	0.494
SDRR (supine)	26.8	(23.1 – 42.2)	32.7	(26.3 – 39.9)	30.7	(25.3 – 42.7)	1.000
Sympathetic/parasympathetic nervous activity ratio	0.924	(0.710 – 1.140)	1.024	(0.805 – 1.152)	0.945	(0.795 – 1.167)	0.589

Group 2: the group which decreased/unchanged scores on giving social support after the program; T1: baseline (before the program); T2: immediately after the program; T3: 3 months after the program; IFN: interferon; IL: interleukin; TNF: tumor necrosis factor; hs-CRP: high-sensitivity C-reactive protein; SDRR: standard deviation of R-R intervals.

creases in giving social support levels are related to decreases in inflammatory markers[8]; a 6-week gratitude intervention resulted in decreases in the percentage of monocytes producing IL-6, TNF-α, and coproducing IL-6 and TNF-α via increases by support-giving behavior. In contrast, the control group did not exhibit such changes. Our results also imply that giving social support to others at work may contribute to improving health by decreasing inflammatory markers on employees themselves.

Although several inflammatory markers had a decrease in Group 1 after the intervention, another physiological measure (ANA) remained unchanged in the same group. The plausible explanation is that positive outcomes may emerge at different timing in each measure[2]. Past participatory workplace intervention studies did not also obtain positive effects simultaneously in all stress-related measures they used in the intervention group[10–12], despite a longer intervention period compared to our study. The various types of measures and timing of evaluation may have resulted in disaggregated findings on inflammatory markers in Group 1 and ANA.

In this study, we did not observe significant differences in the score of receiving social support during the intervention period in both Groups 1 and 2. It was expected that those who had an increase in providing social support (Group 1) may, at the same time, exhibit an increase in receiving social support score, which is based on the norm of reciprocity concept. This point of view needs to be further considered in the future study.

We must consider several limitations to this study. Due to a small sample size and the non-Gaussian distribution of the obtained data, we separated participants into two groups for comparisons. Additionally, there could be other factors such as body mass or medication usage that may have affected inflammatory status. Further studies with a better study design, i.e., randomized control design simultaneously considering aforementioned confounders, are required. Moreover, following factors are desired to be considered in the future study: 1) the amount and timing of social support given at work, 2) how recipients perceived their support provided, and 3) which support (from a supervisor, colleagues, or family, etc.) was beneficial to ones' health.

In conclusion, this study presented a significant insight that increases in giving social support to others at work may have positive health effects on employees themselves via reducing inflammation in ones' body.

Conflict of Interest

The authors do not have a conflict of interest to disclose.

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Appendix 1. Changes of perceived job stress in Group 1 over time (n=13)

	Number of items	T1			T2			T3			*p*-value	*p*-value (pairwise)[b]
		α	Median	Interquartile range	α	Median	Interquartile range	α	Median	Interquartile range		
Social support received	3	0.85	23.0	(20.3 – 28.5)	0.81	23.0	(21.0 – 27.8)	0.87	24.0	(19.0 – 27.0)	0.488	
Psychosocial job stress:												
Quantitative workload[a]	3	0.66	10.0	(8.0 – 10.5)	0.23	9.0	(8.5 – 11.0)	0.65	9.0	(8.0 – 10.5)	0.836	
Qualitative workload[a]	3	0.59	10.0	(9.0 – 12.0)	0.70	10.0	(9.0 – 11.0)	0.80	9.0	(9.0 – 11.0)	0.590	
Job control	3	0.77	8.0	(6.5 – 9.0)	0.77	8.0	(5.0 – 9.0)	0.78	7.0	(6.0 – 9.0)	0.902	
Interpersonal conflict[a]	3	0.27	6.0	(5.5 – 7.0)	0.67	6.0	(5.0 – 7.5)	0.68	7.0	(5.0 – 7.0)	0.905	
Psychological and physical stress reactions:												
Vigor	3	0.93	6.0	(3.5 – 6.5)	0.80	6.0	(4.0 – 8.0)	0.82	5.0	(3.5 – 6.0)	0.065	
Irritation[a]	3	0.74	6.0	(5.0 – 8.0)	0.79	5.0	(3.0 – 7.0)	-0.07	5.0	(4.0 – 5.5)	0.048	T1 vs. T2: 0.350, T1 vs. T3: 0.150, T2 vs. T3: 1.000
Fatigue[a]	3	0.84	7.0	(5.5 – 8.5)	0.87	6.0	(4.5 – 8.0)	0.86	6.0	(4.0 – 8.0)	0.020	T1 vs. T2: 0.093, T1 vs. T3: 0.150, T2 vs. T3: 1.000
Anxiety[a]	3	0.59	5.0	(4.0 – 6.5)	0.81	5.0	(3.0 – 7.0)	0.23	4.0	(3.5 – 5.5)	0.735	
Physical stress response[a]	11	0.79	18.0	(14.5 – 21.5)	0.84	17.0	(14.5 – 22.5)	0.81	17.0	(14.5 – 20.0)	0.643	
Job satisfaction	4	0.76	9.0	(7.5 – 10.5)	0.63	9.0	(7.5 – 10.5)	0.79	9.0	(8.5 – 9.5)	0.674	
CES-D[a]	20	0.74	16.0	(11.0 – 18.5)	0.88	12.0	(7.5 – 18.0)	0.91	11.0	(7.0 – 22.5)	0.302	

[a]Negatively oriented

[b]Bonferroni test

Group 1: the group which increased scores on giving social support after the program; T1: baseline (before the program); T2: immediately after the end of intervention; T3: 3 months after the intervention; CES-D: Center for Epidemiologic Studies Depression Scale.

Appendix 2. Changes of perceived job stress in Group 2 over time (n=17)

	Number of items	T1			T2			T3			*p*-value	*p*-value (pairwise)[b]
		α	Median	Interquartile range	α	Median	Interquartile range	α	Median	Interquartile range		
Social support received	3	0.90	25.0	(21.0 – 26.0)	0.91	21.5	(18.5 – 24.8)	0.91	22.0	(20.0 – 26.0)	0.038	T1 vs. T2: 0.081, T1 vs. T3: 0.399, T2 vs. T3: 1.000
Psychosocial job stress:												
Quantitative workload[a]	3	0.76	9.0	(6.5 – 9.5)	0.70	9.0	(8.0 – 10.0)	0.88	9.0	(8.0 – 9.5)	0.491	
Qualitative workload[a]	3	0.46	9.0	(8.5 – 10.0)	0.81	9.0	(8.0 – 10.0)	0.64	9.0	(8.5 – 10.0)	0.920	
Job control	3	0.42	7.0	(6.5 – 8.0)	0.68	7.0	(6.0 – 8.0)	0.68	7.0	(6.0 – 8.0)	0.839	
Interpersonal conflict[a]	3	0.34	6.0	(6.0 – 7.0)	0.58	6.0	(5.0 – 7.0)	0.68	6.0	(6.0 – 7.0)	0.353	
Psychological and physical stress reactions:												
Vigor	3	0.93	5.0	(3.0 – 6.0)	0.99	3.0	(3.0 – 6.0)	0.90	5.0	(3.0 – 6.0)	0.098	
Irritation[a]	3	0.94	6.0	(4.0 – 7.0)	0.86	6.0	(4.0 – 8.5)	0.90	6.0	(3.5 – 8.0)	0.699	
Fatigue[a]	3	0.95	7.0	(6.0 – 9.0)	0.93	8.0	(4.5 – 9.0)	0.97	9.0	(6.0 – 9.0)	0.979	
Anxiety[a]	3	0.83	5.0	(3.0 – 7.0)	0.78	5.0	(3.5 – 7.5)	0.59	4.0	(3.0 – 5.5)	0.257	
Physical stress response[a]	11	0.79	19.0	(15.0 – 24.0)	0.76	18.0	(15.5 – 25.0)	0.78	15.0	(13.0 – 21.8)	0.116	
Job satisfaction	4	0.62	9.0	(8.0 – 10.0)	0.74	9.0	(8.0 – 10.0)	0.79	9.0	(8.0 – 10.0)	0.794	
CES-D[a]	20	0.79	12.5	(9.3 – 19.5)	0.90	14.5	(8.0 – 19.0)	0.81	12.0	(6.5 – 16.0)	0.229	

[a]Negatively oriented

[b]Bonferroni test

Group 2: the group which decreased/unchanged scores on giving social support after the program; T1: baseline (before the program); T2: immediately after the end of intervention; T3: 3 months after the intervention; CES-D: Center for Epidemiologic Studies Depression Scale.