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Mental Health Status of Municipal Solid Waste Incinerator Workers Compared with Local Government Office Workers

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Abstract: Recently in Japan dioxin problem of municipal solid waste incinerator (MSWI) became social issue. The news spread all around Japan and induced fear that workers at incinerators would suffer from cancer or other serious illness induced by the exposure to dioxins. Authors were interested in the effect of this stressful event occurred to the workers and intended to evaluate mental health status of MSWI workers compared with office workers. Subjects were male workers from two MSWI plants and a local government office; 20 government office workers who were engaging in health administration and 55 MSWI workers. Subjects were interviewed about their age, educational carrier, and working schedule. POMS and GHQ30 were used to evaluate mood status of subjects. There were differences in mood state between the two occupational groups. POMS showed that Tension-Anxiety, Depression-Dejection, and Fatigue levels were high in the health administration worker group. GHQ30 showed that General Illness, Social Dysfunction, and Anxiety and Dysphoria state were deviated to abnormal in the health administration worker group. General mental health status evaluated by GHQ30 score was also deviated to abnormal in the office worker group. Our results showed that mental health status of health administration workers was less healthy compared with MSWI workers. This meant that the stress of MSWI workers enhanced by the fear that they might have been exposed to dioxin did not exceed the stress the health administration workers usually had suffered from.

Key words: Municipal Solid Waste Incinerator, Dioxin, POMS, GHQ30

Introduction

Nowadays stress in workplace is big issue in Japan. By the survey of 16,000 workers, the proportion of workers who had feelings of anxiety, affliction or stress about their occupation or work life was increasing every year and in year 2002 it became 61.5%[1]. Suicide cases have also increased to 32,325 in year 2004 and 10,443 cases had testamentary letter, of which 628 cases (6.0%) were related to occupational problem[2]. The results of another survey asking managers of companies what are the important measures to promote the mental health status of work place showed that the items of questionnaire responded around 50% or more were followings; train the responsible personnel, elucidate the relation between stress and ill health, develop the simple method to measure stress, and develop the stress management skill[3].

Office workers are suffering from many kinds of work place stress such as; VDT environment, changing of promotion system from seniority-oriented to ability and achievement-oriented system, stress specific to aged worker, increase of part-time position etc.[4] On the other hand, workers at manufacturing industry are suffering from stress relating to; work with low controllability, monotonous work, low skill demand with high work load, tight schedule, irregular working time etc.[5]

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Recently in Japan dioxin problem of municipal solid waste incinerator (MSWI) became social issue. In 1990's most of dioxins (polychlorinated dibenzo-para-dioxins, polychlorinated dibenzofurans, and coplanar polychlorinated biphenyl) emitted to environment in Japan were from MSWI[6]. And these dioxins are produced during incineration and contaminated mainly to fly ash and some are in gaseous phase[7–9]. The public realized that workers of the incinerators have been in high risk of exposure to dioxins. The survey of workers at a MSWI at Kansai by Ministry of Labor revealed that some workers were exposed to dioxins at relatively high dose[10]. The news spread all around Japan and induced fear that workers at incinerators would suffer from cancer or other serious illness induced by the exposure to dioxins. It must have added further stress over the workers other than the stress relating to regular work at MSWI, which may be similar to general plant workers. Authors are especially interested in the effect of this stressful event occurred to the workers and evaluated mental health status of MSWI workers compared with office workers.

Methods

Subjects

Subjects were workers from two MSWI plants and a local government office who agreed to join the interview and responded to the questionnaires. All subjects were male; 25 government office workers and 55 MSWI workers. Office workers were engaged in works relating to health administration. MSWI workers were engaged in managements, reception of wastes, control of furnace, and maintenance of facilities.

Subjects were interviewed about their age, educational carrier, and working schedule.

Evaluation of mental health status

Japanese version of Profile of Mood States Test (POMS)[11] was used to evaluate mood status of subjects. The test consists of 65 questions and responder were asked to evaluate their mood state over the previous week by five-point scale ranging from "no" to "quite frequently", which is scored from 0 to 4. The test classifies mood status to 6 states, those are tension-anxiety (T-A), depression-dejection (D), anger-hostility (A-H), vigor (V), fatigue (F), and confusion (C). The scores of each group were summed up to construct a crude total score. The difference between the crude total scores and specific standard mean score concerning gender and age was scaled by the specific standard deviation, which we abbreviate as S, and classified to three levels; those are 'abnormal' ($S<-2.5$ or $2.5<S$), 'slightly abnormal' ($-2.5\leq S<-1$ or $1<S\leq 2.5$), and 'normal' ($-1\leq S\leq 1$). For our analysis we combined 'abnormal' and 'slightly abnormal' to one category, which we called the category 'deviated'.

We also used Japanese version of General Health Questionnaire including 30-item scales (GHQ30)[12], which is widely used to evaluate general mental health status. Responders were asked to evaluate their psychological well-being over the previous two to three weeks by four-point scale ranging from 'never' to 'all the time'. Two points, those are 'all the time' and 'some time' were scored as 1 and other two were scored as 0. All 30 scores are added up to make GHQ30 score, which ranges from 0 to 30. GHQ30 score under 7 is classified as normal and the score over or equal 7 were classified as abnormal[13]. Thirty items are constructed from 6 mental state categories; those are General Illness (Cat 1), Somatic Symptoms (Cat 2), Sleep Disturbance (Cat 3), Social Dysfunction (Cat 4), Anxiety and Dysphoria (Cat 5), and Suicidal Depression (Cat 6). The scores of items belonging to each category were summed up to make an Element score (E score). E scores range from 0 to 5 are classified as normal, slightly abnormal, and moderately abnormal depending on the score. For our analysis we combined 'slightly abnormal' and 'moderately abnormal' to one category, which we called the category 'deviated'.

Each subject was isolated far enough from the others in the quiet room to fill the questionnaire. All subjects finished the tests within 20 min.

Statistical analysis

Comparisons of means were tested by t-test. Existences of association in contingency tables were tested by chi-square test and analyzed by odds ratio. Multiple regression analysis was used for further analysis. All statistical analyses were conducted using SPSS 12.0J for Windows.

Results

The distributions of age and educational carrier in year by job categories were shown in Tables 1 and 2, respectively. There were no difference in age between two work categories, but there was significant difference in educational carrier. The office worker had longer carrier in education. Two-way distribution by work schedule and work categories is shown in Table 3. Two-third of MSWI workers have engaged in shift work but none among government office workers.

The distributions of MSWI workers and office workers on the two categories, those are 'normal' and 'deviated', by six mood states of POMS were shown as 2×2 contingency

Table 1. Age distribution in year by work categories

Work categories / Age	20–29	30–39	40–49	50–59	60–69	Total	Ave. age
MSWI workers	5	13	16	18	3	55	44.9
Government office workers		6	10	9		25	46.2
Total	5	19	26	27	3	80	45.3

Table 2. Educational carrier in year by work categories

Work categories / Educational carrier	9	10–12	13–16	Total	Ave.
MSWI workers	10	31	14	55	12.2
Government office workers	0	0	25	25	16.0*
Total	10	31	39	80	13.4

*: $p<0.01$ between two work categories by t-test.

Table 3. Distribution by work schedule and work categories

Work categories / Work schedule	Day work	Sift work	Total
MSWI workers	16	39	55
Government office workers	25	0	25
Total	41	39	80

$p<0.01$ by Fisher's exact test.

tables (Table 4). Neither of table had significant deviation from independency between two variables. Multiple regression analyses using crude total score of each mood state as dependent value and job, age, work schedule and educational carrier as independent values were carried out. Results are shown on Table 5. The factor 'Job' was significant at T-A and D and nearly significant at F, which showed that the score of respective moods were high among office workers compared with MSWI workers.

The distributions of MSWI workers and office workers on the two categories, those are 'normal' and 'deviated', by six states of GHQ30 were shown as 2 × 2 contingency tables (Table 6). Cat 1 and Cat 5 had significant and Cat 4 had nearly significant deviation from the independency. Odds ratios were 3.17, 4.62, and 3.00, respectively. GHQ30 score also had significant deviation from independency and the odds ratio was 3.31. All these results showed that the percentage of deviated subjects was high in the office workers compared with the MSWI workers. Multiple regression analyses using row score of each GHQ30 state as dependent value and job, age, work schedule, and educational carrier as independent values were carried out. Results are shown on Table 7. The factor 'Age' was significant at Cat 3 and nearly significant at Cat 6 but 'Job' was not significant factor.

Discussion

The levels of mood states between the two occupational groups were different. Tension-Anxiety, Depression-Dejection and Fatigue levels were high in the office worker group. GHQ30 showed that General Illness, Social Dysfunction, and Anxiety and Dysphoria state were deviated to abnormal in the office worker group. General mental health status evaluated by GHQ30 score was also deviated to abnormal in the office worker group.

Factory workers have been reported to have big work place stress by their work style compared with office workers. Surveys on the Netherlands[14] and on the United States[15] showed that in those occupations with high work pace and/or low skill discretion, the risk of mental health disorders is highest. Watanabe[5] states that repeated, monotonous, low demand of skill, and low controllability work would be important stress factor.

On the other hand, in some countries there are data for mental health outcomes as related to occupational groups. Occupational groups that are especially prone to drop out for reasons of mental ill health in the Netherlands are those in the service sector, such as health care personnel and teachers, as well as cleaning personnel, housekeepers and occupations in the transport branch[16]. In the United States, occupations which were highly prone to major depressive disorder, as diagnosed with standardized coding systems (i.e., the third edition of the Diagnostic and Statistical Manual of

Table 4. Six mood states of POMS were shown as 2 × 2 contingency tables

Mood states of POMS / Work categories		MSWI workers 55	(%)	Office workers 25	(%)
Tension-Anxiety	Normal	30	(54.5)	18	(72.0)
	Deviated	25	(45.5)	7	(28.0)
Depression-Dejection	Normal	44	(80.0)	19	(76.0)
	Deviated	11	(20.0)	6	(24.0)
Anger-Hostility	Normal	35	(63.6)	18	(72.0)
	Deviated	20	(36.4)	7	(28.0)
Vigor	Normal	37	(67.3)	13	(52.0)
	Deviated	18	(32.7)	12	(48.0)
Fatigue	Normal	39	(70.9)	16	(64.0)
	Deviated	16	(29.1)	9	(36.0)
Confusion	Normal	41	(74.5)	17	(68.0)
	Deviated	14	(25.5)	8	(32.0)

Table 5. Multiple regression analyses using crude total score of each mood state as dependent value and job, age, work schedule, and educational carrier as independent values

		SS	df	F	*p*	Predictor	Coefficient	*p*
Tension-Anxiety	Regression	217	4	1.83	0.131	Occupation	–4.68	0.036
	Residual	2,218	75			Age	–0.06	0.1<
	Total	2,435	79			Schedule	1.55	0.1<
						Education	–0.14	0.1<
Depression-Dejection	Regression	361	4	1.36	0.2<	Occupation	–7.12	0.033
	Residual	4,975	75			Age	–0.09	0.1<
	Total	5,336	79			Schedule	1.70	0.1<
						Education	–0.65	0.1<
Anger-Hostility	Regression	252	4	1.24	0.2<	Occupation	–2.63	0.1<
	Residual	3,825	75			Age	–0.02	0.1<
	Total	4,077	79			Schedule	–0.57	0.1<
						Education	0.18	0.1<
Vigor	Regression	126	4	0.95	0.2<	Occupation	–3.29	0.1<
	Residual	2,481	75			Age	0.00	0.1<
	Total	2,607	79			Schedule	–1.80	0.1<
						Education	–0.07	0.1<
Fatigue	Regression	402	4	3.46	0.012	Occupation	–4.25	0.053
	Residual	2,178	75			Age	–0.01	0.1<
	Total	2,580	79			Schedule	–0.15	0.1<
						Education	0.12	0.1<
Confusion	Regression	149	4	3.06	0.022	Occupation	–2.13	0.1<
	Residual	910	75			Age	0.02	0.1<
	Total	1,059	79			Schedule	0.48	0.1<
						Education	0.25	0.1<

Mental Disorders (DSM III))[17], are juridical employees, secretaries and teachers[18].

Our results showed that mental health status of office workers engaging in health administration was less healthy compared with MSWI workers. This means that the stress of MSWI workers enhanced by the fear that they might have been exposed to dioxin, which have been alarmed by the mass media as 'most toxic substance exists in the earth', did not exceed the level of stress that health administration workers usually had suffered from. In Japan factory workers

Table 6. Six states of GHQ30 were shown as 2 × 2 contingency tables

States of GHQ30 / Work categories		MSWI workers 55	(%)	Office workers 25	(%)	*p* (chi–square)	Odds ratio (95%CI)
General illness	Normal	41	(74.5)	12	(48.0)	0.024	3.17
	Deviated	14	(25.5)	13	(52.0)		(1.18–8.55)
Somatic symptoms	Normal	45	(81.8)	19	(76.0)	0.1<	1.42
	Deviated	10	(18.2)	6	(24.0)		(0.45–4.47)
Sleep disturbance	Normal	35	(63.6)	12	(48.0)	0.1<	1.90
	Deviated	20	(36.4)	13	(52.0)		(0.73–4.94)
Social dysfunction	Normal	45	(81.8)	15	(60.0)	0.051	3.00
	Deviated	10	(18.2)	10	(40.0)		(1.05–8.60)
Anxiety & dysphoria	Normal	47	(85.5)	14	(56.0)	0.009	4.62
	Deviated	8	(14.5)	11	(44.0)		(1.55–13.71)
Suicidal depression	Normal	52	(94.5)	22	(88.0)	0.1<	2.36
	Deviated	3	(5.5)	3	(12.0)		(0.44–12.63)
GHQ score	Normal	43	(78.2)	13	(52.0)	0.033	3.31
	Deviated	12	(21.8)	12	(48.0)		(1.20–9.10)

Table 7. Multiple regression analyses using row score of each GHQ30 state as dependent value and job, age, work schedule and educational carrier as independent values

		SS	df	F	*p*	Predictor	Coefficient	*p*
General illness	Regression	16.7	4	2.78	0.033	Occupation	0.40	0.1<
	Residual	112.8	75			Age	0.00	0.1<
	Total	129.5	79			Schedule	–0.32	0.1<
						Education	0.07	0.1<
Somatic symptoms	Regression	1.6	4	0.39	0.2<	Occupation	0.32	0.1<
	Residual	77.2	75			Age	0.00	0.1<
	Total	78.8	79			Schedule	0.38	0.1<
						Education	–0.01	0.1<
Sleep disturbance	Regression	21.5	4	2.11	0.088	Occupation	–0.08	0.1<
	Residual	192.0	75			Age	0.05	0.009
	Total	213.5	79			Schedule	–0.09	0.1<
						Education	0.08	0.1<
Social dysfunction	Regression	6.0	4	1.35	0.2<	Occupation	0.31	0.1<
	Residual	84.0	75			Age	0.00	0.1<
	Total	90.0	79			Schedule	–0.02	0.1<
						Education	0.05	0.1<
Anxiety & dysphoria	Regression	10.8	4	1.87	0.124	Occupation	0.75	0.1<
	Residual	107.6	75			Age	0.00	0.1<
	Total	118.4	79			Schedule	0.33	0.1<
						Education	0.05	0.1<
Suicidal depression	Regression	5.7	4	2.08	0.092	Occupation	0.57	0.088
	Residual	51.1	75			Age	–0.02	0.051
	Total	56.8	79			Schedule	0.00	0.1<
						Education	–0.04	0.1<

are well managed in work time and work condition. Even though they have sift work, the schedule is regular and they can control their private life out of work hour by themselves freely. But office workers especially who have specialty in their work were not restricted to their work hours and the load of work invades to their private life. Work place stress

of our office worker group may be more similar to the service sector, such as health care personnel and teachers, as well as cleaning personnel, housekeepers and occupations in the transport branch in Europe and juridical employees, secretaries and teachers in US.

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