Table 5.　イベントからの年数と各尺度得点の　相関係数

		SDS	シーハン不安尺度	JCQ Demand	JCQ Control	JCQ 上司サポート	JCQ 同僚サポート	IES-R
男性	自然災害	−0.24		−0.33				
	交通事故			−0.14				
	その他				−0.39			
	言葉の暴行			−0.19				
	ショック	−0.48						
	Factor Ⅱ	−0.14		−0.20		−0.11		−0.13
	Factor Ⅲ							−0.16
	Factor Ⅳ		0.47					
女性	交通事故			0.57				−0.52
	言葉の暴行						−0.61	
	Factor Ⅱ			0.60				−0.50

Pearson の積率相関係数　$p<0.05$

Table 6.　各尺度における因子変数の主効果と交互作用

		タイプⅢ平方和	自由度	F	
SDS	年齢	1066.06	1	23.49	*
	Strain	680.49	1	14.99	*
	上司サポート	221.21	1	4.87	**
	同僚サポート	638.84	1	14.08	*
シーハン不安尺度	年齢	13876.41	1	39.54	*
	event 有無	15607.60	1	44.47	*
	同僚サポート	1902.14	1	5.42	**
	性別	2141.93	1	6.10	**
	上司サポート*性別	1351.41	1	3.85	0.05
JCQ Demand	年齢	452.38	1	24.18	*
	性別	847.65	1	45.31	*
	Strain	4791.70	1	256.14	*
	出来事有無*Strain	80.43	1	4.30	**
JCQ Control	年齢	568.54	1	7.52	*
	性別	1751.55	1	23.17	*
	Strain	18839.14	1	249.24	*
	同僚サポート	891.75	1	11.80	*

年齢を共変量とした GLM　*　$p<0.01$　**　$p<0.05$

海外就労経験者のメンタルヘルス

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緒言：海外就労は、就労国との文化の違いや生活環境の変化等により就労者のメンタルヘルスに影響を及ぼすと考えられ、海外就労経験者のメンタルヘルス上の問題が報告されている。しかし、それらの研究は数が少ない上、帰国直後の短期的な影響にのみ焦点が当てられ、長期的な影響については触れられていない。今後国際化が進むつれ、海外就労者が増加することが予想され、今後の対策を考えるためにも海外就労経験者の帰国後の長期的な状況を評価することは重要である。
方法：対象者は、日本の地方都市にある中規模メーカーT社健康診断時に質問票を配布し、回答の得られた3315名のうち、女性と性別の不明な者及び他社からの出向者を除いた2233名である。その中で、6ヶ月以上の海外就労経験のある経験者群と未経験者群に分け、SDS、カラセック、睡眠、IES-R、及びシーハン不安尺度おける差異を検定した。また、事務職（ホワイトカラー）、工場労働者（ブルーカラー）それぞれの間における海外就労経験者と未経験者、及び両者間の比較も検討した。加えて、意に反する海外就労の有無と各尺度の比較も行った。
結果：海外就労経験の有無と上述した尺度の比較の中で、経験者群はカラセックにおける裁量権・上司サポート・同僚サポート、及び睡眠点数において有意にスコアが高かった。(Table 1) ホワイトカラーにおいて、経験者群はカラセックにおける上司サポート、及び睡眠点数が有意に高いスコアを示した。(Table 2) ブルーカラーにおいては、経験者群はカラセックにおける裁量権のみ有意に高いスコアを示した。(Table 3) 海外就労経験者におけるブルーカラーとホワイトカラー間の比較では、経験者群はカラセックの要求度・裁量権・同僚サポート、及び睡眠時間に有意に高いスコアを示した。(Table 4)意に反する海外就労の有無による各尺度の比較では、両群間に有意は認められなかった。(Table 5)
考察：海外就労経験は帰国後のメンタルヘルスに影響を与えるとされるが、本研究においてはうつや不安といったメンタルヘルス上の影響を示さなかった。これは先行研究の結果と併せて考えると、海外就労経験は短期的な影響を生じるが、長期的にはその影響が消失する可能性が示唆された。また、望まない海外就労をした者とそうでない者の間にも顕著な差はみられなかった。その一方で、カラセックにおいては差が認められ、職業上のストレスが経験者群において高かったことは、彼らが現在職場環境に関する問題を抱えているか、海外就労経験によってストレス耐性が下がっている可能性が考えられる。今後、これらについて更なる研究が必要である。

緒言

海外就労は、就労国との文化の違いや生活環境の変化等により就労者のメンタルヘルスに影響を及ぼすと考えられている。今後国際化・ボーダレス化がさらに進むつれ、海外就労者数はより増加することが予想され、また昨今の不安定な世界情勢を鑑みても海外就労者への会社、社会の適切なケアが求められるようになってきている。海外就労者についての今後の施策、対応を考えるためにも、彼らの帰国後の状況を的確に評価することは重要である。津久井は発展途上国勤務者において、約 40%が神経症圏、約 20%が抑うつ状態圏にあったと報告している。また、郷司らは、海外赴任者における派遣前後の GHQ (General Health Questionnaire)得点の比較を行い、派遣前のうつ的傾向要素と不安不眠要素の高いものにおいては帰国時のストレスが悪化することを報告している。これらの研究は海外勤務者のメンタルヘルスへの対応が差し迫った重要課題であることを示唆している。しかし、これらの研究においては、海外滞在中あるいは帰国直後の短期的な影響にのみ焦点が当てられ、これらが一時的な不適応によるものなのか、遷延した影響を与えうるものなのかは明らかではなく、海外就労者の帰国後の長期的な影響を示した研究はこれまでにない。また、職業性ストレスはうつや不安といった一般的なメンタルヘルスの問題と共に職域では重要な要素であるが、職業性ストレスについて海外就労経験がどのような影響を与えるかについても明らかにされていない。加えて、海外就労経験の期間の長短が影響を与える可能性があるが、これまでの研究においては必ずしも明確に示されてこない傾向があった。本研究では、海外就労経験をもつことが、メンタルヘルスに対してどのような影響を与えるかを、長期海外就労の経験をもつ日本人労働者を対象に、うつ、不安に加え職業性ストレスについても検討し、海外就労経験の長期的な影響を包括的に示すことを目的とする。

方法

対象者は、日本の地方都市にある中規模メーカーT 社健康診断時に質問票を配布し、回答の得られた 3315 名のうち、女性と性別の不明な者及び他社からの出向者を除いた2233名である。女性を除外したのは海外勤務経験者が全くいなかったからである。その中で、海外就労経験のある者のうち6ヶ月以上の海外就労経験があるものを経験者群、まったく海外就労経験をもたないものを未経験者群に分けた。対象者の年齢は、海外就労経験者群で42.4歳、未経験者群で42.6歳であり両群間において有意差は見られなか

った。両群について、抑うつ状態を評価するSDS、不安障害のスクリーニングに用いられるシーハン不安尺度、そして職業性ストレスを評価するカラセックのJob Content Questionnaire（要求度、裁量権、上司サポート、同僚サポート）を用い、それぞれにおける差異を比較した。また、海外就労経験者の中で事務職（ホワイトカラー）と工場労働者（ブルーカラー）間の各尺度点数を比較し、またカラーごとに海外就労経験の有無により各尺度得点の比較を行った。加えて、海外勤務経験者における、余暇を楽しめたかどうか、家族同伴だったか否か、また、意に反する海外就労であったか否かにより各尺度の比較も行った。また最後に、海外における滞在期間、および帰国後の期間と各尺度得点の相関を検定した。なお、海外における滞在期間について、複数回海外就労経験をもつ者においては、6ヶ月以上の海外就労すべてを加えた期間を用いた。統計は、連続量についてはすべてt検定を用いた。

結果

海外就労経験者の平均滞在期間は29.1ヶ月（SD: 2.66, 範囲: 6-84）であり、帰国後から調査時期までの平均期間は63.9ヶ月（SD: 9.12, 範囲: 6-216）であった。

海外就労経験の有無と上述した尺度の比較の中で、経験者群はカラセックにおける裁量権・上司サポート・同僚サポートにおいて有意にスコアが高かった。(Table 1)また、ホワイトカラーにおいて、経験者群はカラセックにおける上司サポートが有意に高いスコアを示した。(Table 2) ブルーカラーにおいては、経験者群はカラセックにおける裁量権において有意に高いスコアを示した。(Table 3) 海外就労経験者におけるブルーカラーとホワイトカラー間の比較では、経験者群はカラセックの要求度・裁量権・同僚サポート、及び睡眠時間において有意に高いスコアを示した。(Table 4) 意に反する海外就労の有無による各尺度の比較では、両群間に有意は認められなかった。(Table 5) 海外就労期間と各尺度の相関を求めたところ、カラセックにおける要求度にのみ有意な正の相関が認められた。また、帰国からの期間と各尺度との相関を求めたところ、有意な差は認められなかった。家族同伴であるか否かによる各尺度との比較では、カラセックにおける要求度、裁量権、及びシーハン不安尺度において有意な差を認めた。余暇を楽しめたか否かでは、いずれの尺度においても有意な差は認められなかった。

Table 1 海外就労経験の有無と各尺度との比較

	経験者 (n=70)		未経験者 (n=2163)			
	Mean	(SD)	Mean	(SD)	*t*	
年齢	42.44	6.20	42.60	7.67	0.210	
SDS	40.84	7.45	41.30	7.12	0.501	
カラセック要求度	32.85	4.59	32.84	5.01	−0.019	
カラセック裁量権	69.37	8.41	66.15	10.32	−3.124	**
カラセック上司サポート	11.34	1.50	10.87	2.22	−2.546	*
カラセック同僚サポート	11.74	1.33	11.41	1.54	−2.054	*
睡眠点数	4.36	4.92	3.06	4.37	−2.177	*
睡眠時間	6.37	0.84	6.39	0.87	0.204	
IES-R	2.91	8.31	2.78	8.08	−0.137	
シーハン不安	33.81	18.22	35.16	19.45	0.609	
不眠	0.23	0.42	0.18	0.38	−1.014	

** $p < 0.01$　* $p < 0.05$

Table 2 ホワイトカラーにおける海外就労経験の有無と各尺度との比較

	経験者 (n=47)		未経験者 (n=1151)			
	Mean	(SD)	Mean	(SD)	*t*	
年齢	42.98	6.35	42.15	7.91	−0.873	
SDS	41.06	8.12	40.95	7.29	−0.085	
カラセック要求度	33.82	4.94	33.44	5.27	−0.517	
カラセック裁量権	70.85	7.20	70.32	8.25	−0.492	
カラセック上司サポート	11.53	1.43	10.85	2.32	−3.089	**
カラセック同僚サポート	11.98	1.36	11.59	1.45	−1.895	
睡眠点数	4.85	5.13	3.29	4.50	−2.049	*
睡眠時間	6.21	0.86	6.30	0.87	0.676	
IES-R	3.72	9.54	2.93	8.63	−0.560	
シーハン不安	36.38	16.89	35.71	19.54	−0.265	
不眠	0.28	0.45	0.18	0.38	−1.392	

** $p < 0.01$　* $p < 0.05$

Table 3 ブルーカラーにおける海外就労経験の有無と各尺度との比較

	経験者 (n=23)		未経験者 (n=1012)			
	Mean	(SD)	Mean	(SD)	*t*	
年齢	41.35	5.86	43.12	7.37	1.420	
SDS	40.41	6.02	41.69	6.90	1.000	
カラセック要求度	30.87	2.99	32.16	4.61	2.010	
カラセック裁量権	66.35	9.98	61.42	10.40	−2.340	*
カラセック上司サポート	1096.00	1.61	10.89	2.11	−0.210	
カラセック同僚サポート	11.26	1.14	11.20	1.60	−0.250	
睡眠点数	3.35	4.40	2.80	4.19	−0.600	
睡眠時間	6.70	0.70	6.50	0.86	−1.330	
IES-R	1.26	4.69	2.60	7.40	1.330	
シーハン不安	28.57	20.03	34.54	19.34	1.420	
不眠	0.14	0.34	0.17	0.37	0.500	

** p < 0.01　* p <0.05

Table 4 海外就労経験者におけるカラーと各尺度との比較

	ホワイト (n=47)		ブルー(n=23)			
	Mean	(SD)	Mean	(SD)	t	
年齢	42.98	6.35	41.35	5.87	1.062	
SDS	41.06	8.12	40.41	6.02	0.371	
カラセック要求度	33.82	4.94	30.87	2.99	3.095	**
カラセック裁量権	70.85	7.20	66.35	9.98	1.933	*
カラセック上司サポート	11.53	1.43	10.96	1.61	1.457	
カラセック同僚サポート	11.98	1.36	11.26	1.14	2.323	*
睡眠点数	4.85	5.13	3.35	4.40	1.270	
睡眠時間	6.21	0.86	6.70	0.70	−2.505	*
IES-R	3.72	9.54	1.26	4.69	1.448	
シーハン不安	36.38	16.89	28.57	20.03	1.612	
不眠	0.28	0.45	0.14	0.34	1.425	

** p < 0.01　* p <0.05

Table 5 意に反する海外就労の有無と各尺度との比較

	意に反した就労 (n=10)		意に反しない就労(n=52)		
	Mean	(SD)	Mean	(SD)	t
年齢	41.70	5.85	42.38	6.18	−0.336
SDS	39.60	7.50	40.36	7.50	−0.292
カラセック要求度	31.20	3.58	33.24	4.90	−1.544
カラセック裁量権	71.40	9.98	69.31	8.01	0.625
カラセック上司サポート	11.40	1.07	11.37	1.63	0.085
カラセック同僚サポート	11.90	0.57	11.69	1.48	0.763
睡眠点数	4.50	5.40	4.12	4.82	0.210
睡眠時間	6.40	0.70	6.29	0.85	0.445
IES-R	4.20	9.45	1.35	5.08	0.930
シーハン不安	31.10	22.42	32.67	15.97	−0.212
不眠	0.30	0.48	0.21	0.41	0.522

** p < 0.01　* p <0.05

考察

本研究は、海外就労経験の有無と帰国後のメンタルヘルスを職業性ストレスも含めて包括的に検討した初めての研究である。

海外就労経験は帰国後のメンタルヘルスに影響を与えるとされるが、本研究においてはうつや不安の尺度において有意差を認めず、影響がみられなかった。多くの先行研究において、うつやGHQ得点などのメンタルヘルスの指標において海外就労経験の影響が示されているが、これはそれらの研究が海外就労中に行われたものであり、或いは帰国直後に行われた研究であったものであるため、異文化や環境変化による不適応の段階での結果であったのかもしれない。これら先行研究の結果と併せて考えると、海外就労経験は短期的な影響を生じるが、長期的にはその影響が消失する可能性が示唆された。

また、カラセックの Job Content Questionnaire の裁量権、上司サポート、同僚サポートにおいては海外就労経験の有無による有意差が認められ、職業上のストレスが経験者群において高かったことは、海外就労経験がストレス耐性を長期的に下げている可能性を示唆する。今後、これらについて更なる研究が必要である。

さらに、望んで海外就労をした者とそうでない者の間にも有意差はみられず、長期的には望まない海外就労の影響がみられないことが示唆された。海外就労者にとっては現地で彼らを取り巻く環境も重要な要素と考えられるが、家族が同伴するか否かは職業性ストレス及び不安に影響を与えることが示唆された。家族を日本に残して来たものは、本人自身の不安に加え、

残された家族を案じることにより一層の不安を持ち、家族からの身近なサポートが得られなくなったことの影響と考えられる。

本研究の限界として、本研究は横断研究であり、海外就労以前、及び海外滞在中との比較ができないことが挙げられる。また、従業員本人の現在における主観的な回答のみによっており、海外就労当時の状況についての記述には信頼性に関する一定の問題があるかもしれない。さらに、本研究は一つの企業のみで行った研究であり、一般化可能性が限られているかもしれない。また本研究では、ほとんどの海外就労経験者の滞在国は先進国であり、発展途上国における状況は窺い知れない。よって、今後は複数の企業を対象とした前向き縦断研究が望まれる。また、発展途上国における海外就労はより厳しいメンタルヘルス上の影響を生むことが予想されるが、それらの国における海外就労の影響についての研究が必要であろう。

海外就労経験の有無と職業性ストレスを含めたメンタルヘルスを包括的に見た研究は本研究が初めてであり、海外就労経験者の職業性ストレスが悪化し得るという新しい知見を得た。今後、職業性ストレスを焦点にした海外就労経験者のメンタルヘルスに関する更なる研究が望まれる。

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Relationship between perceived social support and immune function

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Abstract

Background: Although a previous meta analysis showed some substantial relationships between social support and immune function, there is still no knowledge about the effects of social support on natural killer (NK) cell number. In this study we examined the direct relationships between peripheral lymphocyte subpopulations and several aspects of social support.

Method: We administered the Japanese version of the Stress and Coping Inventory (SCI) by Rahe et al to 98 male workers with a written informed consent. Blood samples were collected at 10:00a.m. in the morning. Lymphocytes subsets were measured by flowcytometry using CD3,CD4,CD16,CD19 and CD56 antibodies.

Result: Partial correlation coefficient controlled by age and smoking between social support and immune cells revealed that there were weak but significant correlations between perceived social support and the numbers of CD3-/CD16+and CD3-/CD56+ NK cells (r=0.25,0.26). There was no correlations between social support and percentage of NK cells.

Conclusion: Positive correlation of perceived social support with NK cell numbers suggested that perceived social support has a direct effect on NK cells and that increased social support might accompany with high natural immunity. Further investigation should be undertaken to elucidate why only the perceived social support was correlated to NK cells.

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Introduction

Since social support has been proved to have effects on mortality and incidence of diseases, this psychosocial entity has attracted attentions from many researchers of social psychology, health psychology, sociology and medicine. House [1] suggested that individuals isolated from society have shorter life expectancy and that social support has stronger effects on mortality than other risk factors i.e. smoking, Type A behavior.

It is also known that social support has effects on psychological parameters such as depression and anxiety. Previous studies using various populations such as psychotic depression patients[2] ,normal adult workers [3] and college students[4], revealed that there was a negative correlation between social support and depression. Studies on HIV positive patients [5], normal adult workers [6], and the people in the islands of the Southern Pacific Ocean [7] showed that there was a negative correlation between social support and anxiety.

Several interventional studies on cancer and AIDS patients examined the effects of social support on one's health [8-9]. These studies proved that social support improved their prognosis and depressive mood. Although researches in various kinds of fields have shown that social support has influences upon the status of one's health, the mechanisms through which social support has effects, remains to be unclear.

While many researchers proposed several hypotheses for the mechanisms, there is no definite explanation. Cohen and Wills proposed a hypothesis that social support has an effect on one's appraisal of stressors. Consequently social support indirectly affects stress reactions such as anxiety and depression [10]. Another finding notes that social support influences indirectly on one's health via direct influences on health-related behaviors such as physical exercise [11]. The above two pathways can be classified into the hypothesis of indirect effects. On the other hand, the direct effect hypothesis is also presented because there are some evidences relevant to direct effects of quality of social relationships on immune functions in the field of psychoneuroimmunology, highlighted as an area of research to investigate the effects of psychological parameters on physiological ones [12].

Uchino et al [13] concluded that social support has some substantial relationships with immune functions on the basis of meta analysis on social support researches. With respect to psychological parameters that affect immunity, Irwin reported that depression has a negative correlation with the number of natural killer (NK) cells (CD16+) [14]. To our best knowledge, however, there is no research that examined the relationship between social support and NK cell number. Although it was observed that there was no correlation between social support and the percentage of NK cells [15], it is feasible that the results were biased since the sample size

was small and the authors did not use the number but percentage of NK cells. In the present study, in addition to measuring the NK cell number we examined the direct correlation hypothesis of social support on NK cell number in a cross sectional design.

Methods

Participants

A total of 98 male workers (mean age:46.1 ± 7.25) were recruited from a private company in Japan and psychological questionnaires and immunological assessments were executed with written informed consent.

Assessment of social support

The Japanese version of Stress Coping Inventory (SCI) was administered in order to evaluate the level of social support. Rahe developed SCI [16] and Fukunishi standardized the Japanese version of SCI [17]. SCI is a self-administered questionnaire composed of 4 subscales, that is, health-related behaviors, response to stress, social support, and life satisfaction. For the present study, social support scale was utilized from the Japanese version of SCI. The scale is classified into 3 subscales, namely individual social support network, utilization of social support, and perceived social support. The respective subscale consists of 6 items with 0-3 Likert scale.

Immunological assessments

Blood samples were collected in heparinized tubes (Beckton-Dickson, New Jersey, USA) at 10:00 am and stored at a room temperature for no longer than 24 hours before the assays. To determine white blood cell (WBC) subset counts, total numbers of WBC and leukocyte differential counts were determined using a Coulter counter (Beckman Coulter, Inc, Fullerton, CA, USA). Lymphocyte subsets were measured by flowcytometry analysis (EPICS XL, Beckman Coulter, Inc, Fullerton, CA, USA) according to standard methods. Enumeration of the following cells by flowcytometory was conducted using three combinations of two collar analysis: T cells and NK cells (CD3/fluoresein isothyocyanate (FITC) and CD16/phycoerythrin (PE), and, CD3/FITC and CD56/PE), and B cells (CD19/PE) and one type of T cell subsets (CD4/FITC). All antibodies were purchased from Beckman Coulter, Inc (Fullerton, CA, USA).

Statistical analysis

Partial correlation coefficients were calculated to assess the associations of social support with indices of immune function. All differences were significant at a $p < 0.05$, using two-tailed tests. The analysis was conducted with SPSS for windows version 10.0.

Results

Descriptions of the variables used in the present study were shown in Table 1. We conducted partial correlation analysis controlling for age and smoking so as to examine the relations between social support and immune functions. As psychological scales, we used individual social support network, utilization frequency of social support, and perceived social support. As indices of immune cells, we used the numbers and percentages of CD3+, CD4+, CD19+, CD3-/CD16+, and CD3-/CD56+. There were significant correlations between perceived social support and the numbers of CD3-/CD16+ cells and CD3-/CD56+ cells. Perceived social support had a positive correlation with CD3-/CD16+ number ($r=0.25, p<0.05: n=78$) and with CD3-/CD56+ number ($r=0.26, p<0.05: n=78$) (Table2). The other immune parameters (CD3+, CD4+ and CD19+) had no significant correlations with any social support indices. No statistically significant correlations between social support and the percentage of lymphocyte subsets were observed (Table3).

Table1 Descpripstion of the variables

	frequency	mean	S.D.
AGE	98	46.09	7.25
summation of SS	95	30.81	7.82
SSEXISTENSE	95	11.38	3.36
SSUTILIZATION	95	8.23	2.73
SSPERCEPTION	95	11.19	2.74
CD3+ /μl	95	1152.62	763.34
CD4+ /μl	85	809.19	352.20
CD8+ /μl	90	620.49	287.61
CD19+ /μl	93	237.53	206.31
CD3-CD16+ /μl	95	288.13	179.80
CD3-CD56+ /μl	95	292.09	187.81

Table2 Partial correlation between social support and immunological parameters(cell counts) (N=78)

	total score of social support	existense of support	utilization of support	perception of support
CD3+ /μl	0.01	0.03	-0.02	0.00
CD4+ /μl	0.05	0.06	0.03	0.04
CD8+ /μl	0.06	0.05	0.01	0.11
CD19+ /μl	0.10	0.07	0.11	0.10
CD3-CD16+ /μl	0.22	0.17	0.16	0.25*
CD3-CD56+ /μl	0.21	0.17	0.15	0.26*

* $p<.05$ controled by age and smoking

Table3 Correlation between social support and immunological parameters(%) (N=89)

	total score of social support	existense of support	utilization of support	perception of support
CD3-CD16+(%)	0.16	0.11	0.13	0.20
CD3-CD56+(%)	-0.15	0.10	0.12	0.20

* $p<.05$ controled by age and smoking

Discussion

Schlesinger [15] reported that there was no relationship between social support and the percentage of NK cells. We also observed the same null findings in terms of percentages of NK cells, and observed that perceived social support had a weak but significant positive correlation with CD3-/CD16+ and CD3-/CD56+ NK cell numbers. Percentages of particular lymphocyte subsets should be recognized as representing the consequences of cell differentiation rather than the strength of the immunity. To evaluate the immune function of the circulating blood, one should count the cell numbers per unit. Thus our results suggest that social support increases NK cell number and can augment natural immunity.

Cohen et al showed that susceptibility to common cold was associated with the social network diversity as an index of social bondage. The subjects with low social network diversity had higher susceptibility to common cold. They hypothesized that the mediators of the link between social support network and susceptibility to virus infection were attributed to health related behaviors, such as smoking, alcohol intake and exercise, and endocrinolo-immunological system. However, they did not find any correlation between social support network diversity and NK cell activity, which plays an important role to defend against the virus infections. They had to assume other immunological factors than NK cell activity to explain their own results. In our study we also failed to find any correlation between NK cell numbers and social support network but found the correlation with perceived social support. In terms of virus infection, perceived support might be a better predictor.

The results presented showed no relation between social support and indices of T cells (CD4+ and CD8+) and B cells (CD19+). It is consistent with a previous review by Uchino [13] in which there was no correlation between CD4+ number and social support in studies conducted both on 33 (healthy) female[18] and on 221 HIV positive male[19] that simply examined a correlation.

Among three categories of social support, significant positive correlation with NK cell number exists only in the perceived social support. Uchino [13] proposed that, of perceived support, especially emotional support correlates with cardiovascular

responses and has strong effects on mental health such as depression, anxiety, and so on. This proposal could be endorsed in part by the results of the present study that perceived social support correlated with NK cell number in terms of psycho-neuro-endocrine-immune system. As it is possible to interpret that both support network and utilization frequency are parts of perceived support, the results may be biased by the questionnaire method .

The correlation of perceived social support with NK cell number should be taken into consideration when examining the relationship between NK cell number and other psychological valuables. For example, previous studies that examined the relationship between depression and NK cell number are inconsistent and only a meta analysis revealed the effect of depression on NK cell number[14]. Our results might help to understand the complexities of inconsistency of previous research.

Cohen and Willis [10] proposed two hypotheses for the mechanism of the effect of social support on one's health: the direct and buffering hypothesis. The former is that social support has a direct effect on one's health. The latter is that support has an influence just after an exposure to stressors. The results presented here seem to support the direct hypothesis in terms of NK cells. In the previous studies, direct hypothesis was confirmed when the researchers used social integration as an tool for assessing social support, while indirect hypothesis was confirmed when the functional indexes such as perceived support were used as a research tool. However, our results were different from the previous studies. This difference may be due to the kinds of physiological parameters since indirect hypothesis was often confirmed in the relationship between the reactivity of cardiovascular functions and social support.

In the future, it is necessary to investigate the reason that perceived support specifically correlates with NK cell number.

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The association between perceived social support and immune system.

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Associations between perceived social support and comprehensive immune systems were examined. Immunological assessments (T cell count, Natural Killer cell count, Interferon-Gamma, Interleukin-4) and psychological assessment(NIOSH:GJSQ) were administered 578 male company employees with written informed consent. Partial correlation coefficient controlled by age, smoking, alcohol intaking, excersize, and stressor between social support and immune functions revealed that there were weak but significant correlations between perceived social support and Th1/ Th2 balance($r=0.16\sim 0.26$: $p.<.05$). On the other hand interaction effect(support × stressor) was seen on T-cell counts. These findings might imply that direct hypothesis and buffering hypothesis can coexist.

Introduction

Numerous researches have been conducted on social support having a generalized beneficial effect on health and/or a buffering effect on stress. There have been two different hypotheses so far (Simons-Morton, B. et al.,2001: Perry, M C . et al.,2001: Penninx, B W. et al.,1997: Syrotuik, J. et al.,1984).

The standpoint that social support has a generalized beneficial effect on health is referred to as a direct hypothesis or a main effect hypothesis. This conceptualization hypothesizes that the effect of support on health exists independently of stressors and other variables. However, in some cases, the lack of support results in disorders and tension, and in turn increases the risk to mental health. Thus, the other standpoint elicits, in which social support has a buffering effect on stress. This is referred to as an indirect hypothesis or buffering hypothesis, and hypothesizes that an appraisal of stressors acts as a mediating variable when support has an effect on health. Although studies were initially conducted in order to determine which of these two hypotheses was applicable as a model, the recent research showed that the direct hypothesis and buffering hypothesis are not mutually exclusive and that there are cases in which both can exist simultaneously (Thoits, 1995).

Cohen and Willis, et al. (1985) stated that when social integration or structural measures are used as a measure for evaluating social support, the direct hypothesis was preferable, while when the functional support or perceived support is used as a measure , the buffering hypothesis was preferable. However, these researches employed depression, anxiety, psychological symptoms, other aspects of mental health and psychological well-being as dependent

variables.

According to Vilhjalmsson, R. (1993), in the case of using the categorical variable of clinical depression as a dependent variable, rather than a linear probability model, logit model is more applicable both theoretically and statistically. A survey of those results (consisting of research in 12 countries) revealed that the models of the social support effects change according to dependent variables as well.

Uchino, et al. (1996) conducted a meta-analysis on the correlation between social support and the functional measure of immunity, and discovered a significant correlation between social support and functional immune parameters. However, a meta-analysis has not been conducted on the correlation between social support
and quantitative measures lymphocyte subpopulations since there were only four reports dealing with this correlation. Three of these reports described the research on HIV carriers. As HIV infect the CD4+ T cells via CD4 molecule, it was dangerous to discuss the results of HIV researches and other psychoneuroimmunological researches in the same paradigm. Only one study using normal healthy subjects was conducted by McNaughton, et al. (1990) on 33 women to assess the correlation between CD4+, CD8+ counts, their ratio and social support. They observed a negative correlation between CD8+ count and emotional perceived support. In other words, there is few knowledge with respect to the manner in which the various aspects of social support affect quantitative parameters of the immune system. On the other hand, the direct hypothesis of functional immune parameters and social support is supported by meta-analysis.

In addition, among six researches on the buffering hypothesis that have been conducted, there have been only one research so far, in which the buffering hypothesis was supported in the analysis of functional parameters (Con A, PHA) (Kiecoelt, 1991). Accordingly, the object of the present research is to make a comprehensive study of the relationship among quantitative parameters of the immune system (T cell counts, etc.) qualitative parameters of the immune system(NKCA, Cytokine, etc.) and social support.

There are two hypotheses for consideration. If only the direct hypothesis is supported, a correlation ought to be observed between social support and immune system parameters after controlling the effects of other variables related to stressors, health related variables and age (use partial correlation analysis). If only the buffering hypothesis is supported, the effect of social support on parameters of the immune system ought to differ according to the degree of stressors (use two-factor analysis of covariance: interaction). We measured social support by questionnaire method and immune parameters by cross sectional design. This study limited to healthy male, because of the gender difference affect immunity.

Method

The subjects consisted of 578 company employees randomly extracted from healthy male specimens. T cell count and Natural Killer(NK) cell count were measured for 210 of these subjects.

Interferon-Gamma(INF γ), Interleukin-4 (IL-4) were measured for 254 of these subjects. NK cell activity(NKCA) were measured for 324 of these subjects. Analysis was conducted after excluding those subjects who did not completely fill out the questionnaire indicated below or for whom there were errors in measurement of immune system parameters. The population's statistical characteristics of the specimen group are as shown in Table 1.

Social Support: Perceived social support was evaluated using a portion of the general job stress questionnaire of NIOSH(Hurrell J.J. & McLaney M.A., 1988). These scales were developed to comprehensively measure occupational stress, and allow the independent use of respective subordinate scales. This social support scale assesses the degree of support currently being provided from respective support sources (from superiors, coworkers and family members and friends). This scale was classified as 1996: Haratani T., 1997). The reliability coefficient of the criteria of the Japanese version was from .68 to .95, which is within the allowed range. In addition, when questionnaires were employed according to type of occupation in which the status of stressors was thought to be different, validity was confirmed since each type of occupation was able to be distinguished as predicted. Subjects were classified according to the mean value of this criteria in order to distinguish a high stressor group and low stressor group.

Cigarette smoking questionnaire: The number of cigarettes smoked per day at the time of surveillance was assessed by a questionnaire.

Physical activity questionnaire: A self-administered physical activity a functional perceived social support measure. The social support from each support source is evaluated according to four items, and the reliability coefficient of each criterion of the Japanese version was from .76 to .84 (Haratani T., Kawakami N., Araki S., Hurrell J.J., Sauter S.L., Swanson N.G., 1996: Haratani T., 1997) Subjects were classified on the basis of the mean value of the total social support scores in order to distinguish a high social support group and low social support group.

Job Stressors: Job stressors were evaluated using a part of the general job stress questionnaire. A breakdown of job stressors consisted of job demands (perceived mental demands). According to previous research, the scores for each of these criteria are useful for distinguishing differences in several occupations, and criterion correlation validity is supported by this(Hurrell J.J., 1985: Haratani T. et al.,

questionnaire was designed to assess daily energy expenditure and weekly physical activity. Validity and test-retest reliability demonstrated adequate levels (Suzuki I., Kawakami N., Shimizu H.,1997: Suzuki I., Kawakami N., Shimizu H.,1998). The questionnaire consists of 9 items on physical activities with various intensity levels that evaluate how many hours a day or week the respondents spend in the respective activity. Estimated metabolic equivalents (METs) are assigned to the physical activities according as their mean intensity levels. One MET corresponds to an energy expenditure of approximately 1 kcal/kg/hr. Daily energy expenditure (kcal/day) and weekly physical activity (kcal/week) were calculated from a physical activity questionnaire and used in

the data analysis.

Alcohol consumption questionnaire: An alcohol consumption questionnaire was composed of 2 items that assessed the frequency of alcohol consumption per month and the amount of drinking per day. The respondents were asked to reply to the latter question by converting gross liquor consumption into net ethanol intake. Weekly ethanol intake was used in the data analysis.

Immunological assessments: Preparation of PBMC: Heparinized blood samples were collected at 10 am from consenting healthy male subjects. The cells were stored at room temperature and processed within 4 h. PBMC were isolated by density-gradient centrifugation on a Lymphoprep (Nycomed, Oslo), according to the manufacturer's instructions. After isolation, the PBMC were washed twice and resuspended at 2 $\times 10^6$ /ml in RPMI 1640 medium containing 10% FCS, 2 mM glutamine, 100 U/ml penicillin and 100 U/ml streptomycin (Dainippon, Tokyo).
Immunological Parameters
Immunologic parameters included total white blood cell (WBC) count, differential for calculation of lymphocyte count, and enumeration of peripheral blood lymphocyte phenotypes (CD3, CD4, CD8, CD16, CD56). All blood sampling was performed between 9 and 12 AM to control for diurnal variation. Blood was maintained at room temperature before assay. Flow cytometry was performed on the same day as sampling.

A single laser flow cytometer (EPICS Elite, Coulter Instruments Laboratories, Hialeah, FL) was used with a whole blood two-color analysis procedure to determine the distribution of lymphocyte phenotypes, based on markers for CD3, CD4, CD8, CD16, CD56.

100 □l aliquots of whole blood, were well mixed and incubated with antibody for 10 minutes at room temperature. Erythrocytes were lysed and washed using the Quick Prep System from Coulter Epics. Stained specimens were run on the Epics Elite flow cytometer using the 488 nm laser line for quantification of percent positive cells by direct immunofluorescence. For the lymphocyte markers of T cells and subsets, bit maps were set for the lymphocyte population of the forward angle light scatter versus a 90°light scatter histogram. For example, the CD3-CD56+ cells were measured in a large bit map encompassing the lymphocyte area of the forward angle light scatter vs. 90°light scatter histogram. The granulocyte area excluded. The percentage of positively stained cells for each marker pair, as well as doubly stained cells, was determined using Quad Stat software (Coulter Epics). Peripheral lymphocyte counts were calculated by multiplying the total white blood cell count by the percentage of lymphocytes as determined from a Coulter MaxM automated hematology instrument. Estimates of absolute numbers of the lymphocyte cell populations positive for the respective surface markers were determined by multiplying peripheral lymphocyte cell counts by the percentage of positive cells for each surface marker (Fletcher MA, Azen S, Adelsberg B, et al.,1989: Fletcher MA, Barron G, et al., 1987).

Cytotoxicity assay: NK cell activity was measured against K562 using a standard 4h -^{51}Cr release assay. Target cells were labeled with [^{51}Cr] sodium chromate (New England Nuclear, Boston, MA) at 37°C for 1h, washed, and resuspended at 2×10^5/ml in RPMI 1640