Biological Correlates of Social Support and Pressure at Work in Managers

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Abstract—The aim was to explore the patterns of correlations between psychosocial stress indices and neuroendocrinological factors in managers. Fifty-eight male managers in three Swedish companies constituted the sample. They answered two questionnaires with 17 selected stress indices and also an organizational test. The indices have been analyzed by means of computations of age adjusted partial correlations with nine different variables analyzed in fasting blood samples. The serum concentrations of lipids were the variables most strongly correlated with psychosocial factors. Neither smoking nor physical activity changed the correlations significantly. Good social support at work and in private life was consistently associated with low adverse serum lipids and corresponding lipoproteins. On the other hand, some indices of social support were associated with indices of high arousal levels. This may indicate a possible psychophysiological "load effect" of some aspects of social support in managers. The analyses of corporate culture measured as "Rules of the Game" indicated that "bureaucracy" was significantly associated with high LDL-cholesterol and low HDL-cholesterol. Managers have special conditions and therefore the patterns of associations between psychosocial conditions and coping strategies on one hand and endocrine-biochemical state on the other hand may be different from those of other groups. To what extent such differences are due to individual characteristics or environmental factors needs to be further investigated. According to the results, however, good social support is in general health promoting also to managers, at least with regard to serum lipids. Bureaucracy, on the other hand, seems to be dangerous to the health of managers.
Key words—lipids, cortisol, fibrinogen, network, corporate culture, stress, male managers

Introduction

MANAGERS REPRESENT AN interesting group because their conditions differ from those of most people in the working population. Because their job is to supervise and institute company policies, they are given power over other people. This means that they have high psychological demands but also a high degree of decision latitude (Bernin & Theorell, in press, Karasek & Theorell 1990). According to the terminology introduced in the demand-control literature this corresponds to an "active" job (Karasek 1979, Karasek R & Theorell T 1990). Individual characteristics related to patterns of coping may also differ between managers and others (Bernin et al., manuscript). The question arises whether these dimen-

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sions that may differentiate managers as a group from many other groups in working life also make difference within the group of managers.

In what ways are different patterns of coping and life situations reflected in bodily functions? In psychoneuroendocrinology the relationships between psychological, and neuroendocrinological parameters are studied as well as their effects on health factors. Several studies have so far investigated acute stress reactions, such as those reflected in catecholamine excretion. There has also been some research on the association between longlasting conditions and more stable stress indicators. For instance an association has been found between social support and lipid levels (Unden et al.1995). According to several studies, good social network with resulting good support may facilitate a healthy lifestyle (Uemara et al. 1996). Jonsson et al. (1999) reported that women with high levels of psychological stress had low job control and low social support. They also reported that men with high social support were more physically active and that men with job strain had low social support. However, psychosocial factors were not related to biological coronary risk factors.

According to another study, the metabolic syndrome may be a mediator of the association between social isolation and cardiovascular disease (Horsten et al. 1999). Contradictory results were reported by Rose et al. (1998) who found an association between negative life events at work and mental strain but no association with serum lipids. Steptoe et al. (1998) noted that men but not women with low social support consumed more alcohol when the number of working hours increased.

In the present study the following questions were addressed: Are the patterns of associations between basic dimensions that are of importance to working people in general and biological factors different in managers than in others? Do those managers who differ from others with regard to self-rated demands, decision latitude, social support and coping also differ with regard to biological health related variables? The biological dimensions that we chose to study are influenced both by life style and by psychosocial factors. We have made no effort to differentiate effects of the psychosocial dimension from those of life style. However, repeated excessive energy mobilization could be regarded as part of an unhealthy life style in which excessive smoking, eating and alcohol consumption could be seen as additional behaviors aiming at improved energy mobilization. Accordingly, the study was focused on the relationship between psychosocial factors and organizational factors in general on one hand and biological variables related to an unhealthy life style on the other hand.

The classes of biological variables studied were:

Serum lipids. Elevated levels of "harmful" lipids and lowered levels of "protective" lipids are related both to life style (low physical activity and high caloric and fat intake) and energy mobilization. Elevated "harmful" serum lipids are part of the metabolic syndrome.

HDL (high-density lipoprotein) is synthesized in the liver and is often labeled "the good cholesterol." Prolonged alcohol consumption seems to increase HDL (Ganrot et al. 1997). Physical activity also increases the HDL levels (Spyckerelle et al. 1993). In a study of middle-aged women, low socio-economic status was associated with low HDL (Wamala et al. 1999).

Apolipoprotein A1 is an important protein in the HDL (high-density lipoprotein) fraction and high levels in HDL and apolipoprotein A1 should be regarded as positive for health.

High levels of LDL (low-density lipoprotein), apolipoprotein B and lipoprotein (a) should be regarded as "unhealthy." Conversely, low levels should be regarded as health

promoting. Police inspectors who lost their jobs and were re-employed after three years showed lower LDL levels after this time (Grossi et al. 1999). Apolipoprotein B is a component in the LDL fraction. During the follow-up after an intervention program in the public sector the apoB/apoA1 ratio was significantly lowered in the intervention group but not in the control group (Orth-Gomér et al 1994).

High serum triglycerides constitute a risk factor for cardiovascular disease. For women it is a more important risk factor than high cholesterol (Lapidus et al. 1985,Björkelund 1992,). In a population-based case-referent study of men and women the relative risk of triglyceridaemia was high for both sexes (Reuterwall et al. 1999). Changes in lifestyle such as taking up smoking or giving up sporting activity, measured in teenagers on two occasions with a five-year interval, were associated with rising levels of triglycerides and cholesterol (Spyckerelle et al. 1993). Although the findings in different studies have not been consistent, smoking is mostly associated with elevated levels of triglycerides and LDL-cholesterol. Long-lasting excessive alcohol consumption is associated with low serum triglycerides (Ganrot et al. 1997). Negative life-events have been shown to be associated with increased level of serum triglycerides (Theorell & Emlund 1993).

Lipoprotein (a) is an independent risk factor for cardiovascular disease. The risk is particularly related to cerebrovascular diseases (Ganrot et al. 1997). Commonly occurring stressful situations of short duration such as examinations had no significant changes on plasma lipid and lipoprotein levels (Niaura et al. 1991).

High serum cholesterol constitutes a risk factor for heart disease that is well known. Pressure at work has been associated with high serum cholesterol levels (Mc Cann et al. 1990, Grossi et al. 1999). In men cholesterol was a stronger predictor of coronary heart disease than triglycerides (Reuterwall et al. 1999).

Acute phase reactants. Fibrinogen reacts to energy mobilization as well as to infections. Fibrinogen is important in the hemostatic process. That stress influences the coagulation systems is known since a long time (Oliver and Boyd, 1957). Psychosocial stress, low education, and unhealthy lifestyle and low decision latitude mediated the effects of low social class on high plasma fibrinogen (Wamala et al.1999). Job strain seemed to be a risk factor for high plasma fibrinogen (Brunner et al. 1996, Tsutsumi et al.1999).

Serum cortisol is elevated during energy mobilization. Acute stress may be reflected in high levels of cortisol (Härenstam & Theorell 1990, Grossi et al.1999, Piercecchi-Marti et al. 1999). Stress-dependent cortisol was strongly related to perturbations of other endocrine axes as well as metabolic and hemodynamic abnormalities (Rosmond, et al. 1998). However, after long lasting stress situations low levels are frequently observed, such as in chronic fatigue syndrome (Demitrack 1991, Cleare 1995). Low social support in men was associated with lower morning cortisol levels (Hasselhorn 1999).

The general hypothesis was that poor psychosocial conditions (excessive pressure in job and lack of social support at work) would be associated with elevated levels of harmful serum lipids and cortisol. Another hypothesis was that there would be associations between the biological risk factors and corporate culture.

Methods

Study Group

This study is part of a study that has been going on in 10 Swedish companies with 288 participants (Bernin & Theorell, in press). The managers were recruited from the three highest levels in the organizations. Some of the Swedish results—the results of OSI2—

TABLE 1

Lifestyle and medical factors. Alcohol units per week on average 1 unit = a glass of beer (284 ml), or glass of wine (125 ml), or one shot of spirits (50 ml).

1a.

Exercise 3 times a week?	Always	Usually	Sometimes	Occasion.	Never	
	10,5 %	22,8%	31,6%	21,1%	12,3%	1,8%

1b.

Smoking?	Yes	No
	9 %	91%

1c.

Alcohol consumption?	Units per week / Mean	Min.	Max.	Std.
	4,99	0,0	30,0	4,46

1d.

	No	Yes
Elevated blood pressure any time?	80,7 %	15,8%
Diabetes Mellitus?	96,5%	-
Elevated lipids any time?	50,9%	21,1

1e.

Medical prescription for blood pressure?	Advice	Medical drugs
	1,8%	5,3%
Medical prescription for lipids?	**Diet**	**Medical drugs**
	7,0%	3,5%

have also been included in the huge CISMS Collaborative International Study of Managerial Stress (Spector et al., in press). The CISMS study has been effected in 24 countries. Three of the Swedish companies, which had good access to health care, offered the possibility for the researchers to collect blood samples. These companies constitute the study base in this study. There were altogether 187 managers in these companies; 67 of those filled in questionnaires and participated in blood sampling as well (36%). Nine of the participants were women. This number was judged to be too low to allow meaningful statistical analyses. Accordingly 58 male managers, with a mean age of 45.5 ranging from 29 to 59 years old, remained for analyses. In this part of the study 12 per cent of the managers was from the highest levels in the organizations and 28 per cent from the second highest levels and 51 per cent from the third highest levels. For some lifestyle and medical factors see Table 1a-1e.

TABLE 2
References for biological assays. Karolinska Hospital 1(2) 2000-04-20.

	Method / Company	*References*
S-Cholesterol	Vitros, Ortho Diagnostics, Rochester NY, USA	Kadinger CL, O'Kell RT. Clinical evaluation of Eastman Kodak's Ektachem 400 Analyzer. Clin Chem 1983;29:498-501. Theodorsen L. Dry reagent technology. Kodak Ektachem 700 XR in clinical enzymology. Scand J Clin Lab Invest Suppl 1993;215:101-111.Reynolds K
S-Triglycerides	Vitros, Ortho Diagnostics, Rochester NY, USA	Kadinger CL, O'Kell RT. Clinical evaluation of Eastman Kodak's Ektachem 400 Analyzer. Clin Chem 1983;29:498-501. Theodorsen L. Dry reagent technology. Kodak Ektachem 700 XR in clinical enzymology. Scand J Clin Lab Invest Suppl 1993;215:101-111.Reynolds K
S-HDL-cholesterol	Liquid N-genous HDL-c assay. Genzyme, USA	Nauck M, Marz W, Jarausch J, Cobbaert C, Sagers A, Bernard D, et al. Multicenter evaluation of a homogeneous assay for HDL-cholesterol without sample pretreatment. Clin Chem 1997; 43: 1622-1629.
S-LDL-cholesterol	Ad modum Friedewald.	Friedewald, W et al. (1972) Clin Chem 18:499.
S-Apolipoprotein-A1	Array, Beckman Instruments, Inc. Brea, CA, USA	JC Sternberg. A rate nephelometer for meassuring specific proteins by immunoprecipitin reactions. Clin Chem 1977; 23: 1456-1464.
S-Apolipoprotein-B	Array, Beckman Instruments, Inc. Brea, CA, USA	JC Sternberg. A rate nephelometer for meassuring specific proteins by immunoprecipitin reactions. Clin Chem 1977; 23: 1456-1464.
S-Lipoprotein (a)	Array, Beckman Instruments, Inc. Brea, CA, USA	JC Sternberg. A rate nephelometer for meassuring specific proteins by immunoprecipitin reactions. Clin Chem 1977; 23: 1456-1464.
P-Fibrinogen	Stago fibrinogen assay, Stago, Trombolyzer, Behnke Elektronik	Vermylen C, de Vreker RA, Verstraete M. A rapid enzymatic method for assay of fibrinogen fibrin polymerisation time (FPT Test). Clin Chim Acta 1963; 8: 418-424.
S-Cortisol	Autodelfia, Wallac OY, Turko, Finland	Hemmilä I, Dakubu S, Mukkala V-M, Siitari H, Lövgren T. Europium as a lable in time-resolved immunofluorometric assays. Anal Biochem 1984; 137: 335-343.

TABLE 3
Means, and 95% confidence intervals of blood analyses.

Blood analyses	Means	95% Conf.Int.	Std.dev.	N
S-Cholesterol	5,55	5,29-5,82	1,00	57
S-HDL	1,50	1,40-1,59	0,36	58
S-LDL	3,39	3,18-3,61	0,81	57
S-ApolipoA1	1,37	1,31-1,43	0,22	56
S-ApolipoB	1,04	0,98-1,11	0,24	56
S-Lipoprotein (a)	0,17	0,12-0,23	0,21	56
P-Fibrinogen	3,67	3,45-3,89	0,78	50
S-Cortisol	350,83	321,76-379,89	109,53	57
S-Triglycerides	1,26*	1.11 – 1.43		57

*geometric means

Blood samples

Blood samples were taken in the morning (about 9 a.m.) before work. The respondents were told to be fasting. The blood samples were sent to the Karolinska Hospital Laboratory. The following blood analyses were performed: S-Cholesterol, S-Triglycerides, S-HDL-high density lipoprotein, S-LDL-low density lipoprotein, S-Lipoprotein (a), S-Apolipoprotein A1, S-Apolipoprotein B, S-Cortisol, and P-Fibrinogen. References for biological assays are presented in Table 2.

Statistical analyses

Serum triglycerides showed skewed distributions. These values were subjected to (natural) logarithmic transformation. Confidence intervals and means can be seen in Table 3. Partial correlations adjusted for age have been analyzed between the blood tests and the psychosocial and organizational indices. Partial correlations have also been tested with adjustment for physical activity and smoking, but these analyses did not change the results significantly and will therefore not be presented. The analyzed indices are a group of six psychosocial indices in the WOLF questionnaire, the eight indices in the OSI2 questionnaire on sources of pressure at work, and finally three indices in the SLOT Organizational

TABLE 4
Internal Consistency Reliabilities (Alpha Coefficients) for Sources of pressure indices / OSI2.

Sources of pressure in your job	N	Min	Max	Mean	Std.	Skewness	Cronbach Alpha
Hard Workload	**255**	**6.00**	**34.00**	**21.34**	**5.29**	**-.219**	**0,77**
Bad work communication	**255**	**8.00**	**47.00**	**27.19**	**7.31**	**-.127**	**0,88**
Home/Work Conflict	**254**	**6.00**	**28.00**	**17.25**	**5.19**	**-.198**	**0,75**
Hard Managerial Role	**256**	**4.00**	**20.00**	**11.49**	**3.23**	**-.010**	**0,60**
Much responsibility	**254**	**4.00**	**20.00**	**11.70**	**3.36**	**.095**	**0,78**
Work Hassles	**255**	**4.00**	**20.00**	**12.28**	**3.20**	**-.167**	**0,58**
Bad recognition	**253**	**4.00**	**22.00**	**11.89**	**3.74**	**-.160**	**0,76**
Hard Organization Climate	**254**	**4.00**	**24.00**	**12.96**	**3.25**	**-.066**	**0,66**

Test. Internal consistency was explored by means of computation of Cronbach alpha coefficients (tables 4, 5, 6).

Questionnaires

OSI2-Occupational Stress Indicator consists of 126 questions. 90 questions are from the original OSI (Cooper, Sloan and Williams 1988, Cooper and Williams 1996). Work Locus of Control Scale (Spector 1988) and some biographic information have been added to this. The Occupational Stress Indicator is divided into five sections: "How you feel about your job," "How you assess your current state of health," "The way you behave generally," "How you interpret events around you," "Sources of pressure in your job," and "How you cope with experienced stress." The questions are divided into 20 indices. In this study we focused on sources of pressure, which was explored by means of 8 indices and had six response choices; very definitely is not a source, definitely is not a source, generally is not a source, generally is a source, definitely is a source, very definitely is a source. For the scale, high scores represented high levels of pressure. The index *hard workload* was constructed of six questions concerning taking work home, working very long hours, conflicting job tasks and demands in the managerial role, work demands influence near relationships and private life. The index *bad work communication* consisted of eight questions concerning lack of guidance and backup, inadequate management development, isolating and lack of encouragement and feedback, feeling undervalued. *Home/work balance* consisted of six questions concerning the partner's attitude towards the job and partner's career, lack of emotional and practical support outside work, as well as pursuing a career in the expense of home life and or because of instability in home life. In the index *hard managerial role* were four questions about supervising other people, being seen as a

TABLE 5
WOLF indices.

Index	N	Min.	Max.	m	Std.	Skew-ness	Cronbach alpha
Manager support	237	1	4	2,86	0,60	-0,16	0,80
Social support	239	2	4	3,32	0,42	-0,56	0,78
Work support	240	1	4	2,95	0,75	-0,49	0,83
Friend support	240	1,25	6	3,02	0,94	0,62	0,79
Good Network	240	1,75	6	4,46	1,00	0,25	0,70
Appreciation	239	1,50	4	3,22	0,50	0,00	0,64

"boss" and having a negative role, travelling and being away from home. Four questions were included in the index *much responsibility* and concerned taking risks and making important decisions as well as dealing with ambiguous situations facing the consequences of one's mistakes. *Work hassles* consisted of four questions concerning keeping up with new innovations and attending meetings and being available as well as lacking colleague support. The index *bad recognition* also consisted of four questions about underpromotion and unclear, or absence of promotion advancement and development. The index *hard organization climate* also consisted of four questions concerning structure, design, and morale in the organization. It also includes changes and factors that were not under the manager's direct control. In the cross-national study, where the OSI2 data was part in, the Cronbach alpha coefficient ranged from very low to very good. But for the Swedish managers (the total study of 288 managers) in this study the Cronbach alpha coefficient was satisfactory (Table 4). The English version of the OSI2 was used without translation.

WOLF-Work, Lipids and Fibrinogen is a project based upon collaboration between occupational health care teams and research institutions (Stockholm MUSIC Study 1991, and 1993). Besides biographic information the questionnaire is divided in 10 areas: work environment, personality and personality behavior, social support, life events, physical activity, diet–smoking–alcohol, sleep, health and illness, female questions, parents and heredity. Indices were constructed on the basis of factor analyses and a rotated component matrix technique. Distributions with skewness below −1 or above 1 were operationally defined as non-normal. Psychosocial indices with such distributions were excluded from analyses. In this study we focused on social support measured in six indices (Table 5). The index *manager support* included five questions that had four response choices—yes, often to no, never—about managerial engagement in personal growth and health, managerial support in work disposition, and feedback, as well as authority in relation to responsibility. The index *social support* consisted of seven questions that had four response choices from fully agree to do not agree at all. It included questions about the atmosphere and solidarity

TABLE 6
Internal Consistency Reliabilities (Coefficient Alphas) for "Rules of the Game" / SLOT indices.

SLOT reference data base / **Index**	N	Min.	Max.	Mean	Std.	Skew-ness	Cronbach alpha
Creative	841	1.38	4.88	3.27	.61	-.34	.73
Bureaucratic	842	1.17	5.00	3.17	.65	-.07	.69
Chaos	840	1.00	5.00	2.53	.67	.51	.75
Male Managers / **Index**	N	Min.	Max.	Mean	Std.	Skew-ness	Cronbach alpha
Creative	188	2.00	4.50	3.33	.55	-.24	.67
Bureaucratic	187	1.67	4.67	3.28	.57	-.15	.68
Chaos	188	1.17	4.33	2.37	.58	.40	.73

at work, colleague support, comprehension, and friendship, as well as getting on well with superiors. *Work support* consisted of four questions with four response choices from fully agree to do not agree at all. They were asked whether there was a special person with a close relationship and who would back them up at work, or other people at work who would lend implements and support at inconvenient times. *Friend support* and *good network* both consisted of four questions and had six response choices from none to more than 15 friends, at work and outside work. *Friend support* was about how many friends who would visit the respondent's home at any time, and how many with whom the respondent can speak about everything very openly. *Good network* was about the number of people with the same interests and the number of people spoken with during a week. The index *appreciation* consisted of two questions with four response choices from fully agree to do not agree at all, and the question was about appreciation from others at work and outside work.

SLOT-Sandberg Lindell Organizational Test is a tool for organizational mapping and for the assessment of change and development (Lindell & Sandberg 1986). It has its theoretical basis in system sciences (Bertalanffy 1964, Miller 1976). Corporate Culture is defined in three principal areas; 1. Rules of the Game, II. Leadership style, and III. Organizational climate. In this study "Rules of the Game" has been analyzed because that was the area which best suited our aims. "Rules of the game" is divided into three indices; *creativity*, *bureaucracy*, and *chaos* (Table 6). The indices have been constructed by means of a reference database of 880 answers. The indices consisted of eight questions with five response choices from no, almost never to yes, almost always. The index *creativity* consisted of eight questions about the working climate, freedom and safety in the organization as well as high innovation and change preparedness, avoidance of negativity and openness for ideas of everyone. The index *bureaucracy* consisted of six questions about rules and formalization where the working tasks are regularized. Instruction rules are preferred rather than initiatives of the employees. *Chaos* consisted of six questions about the reactions in the organization to new ideas, personal initiatives, and punishment. Other ques-

TABLE 7a
"Harmful" serum lipids. Significant partial correlations (p<=0,05). The correlations are adjusted for age.

Blood analyses	Index	Partial correlation = r	Direction of correlation	N	Significance=p
	Psychosocial support				
S-Cholesterol	Good Network	,3708	Negative	51	0,006
S-LDL	Good Network	,4109	Negative	51	0,002
S-Apolipoprotein B	Good Network	,3145	Negative	50	0,023
S-Lipoprotein (a)	Good Network	,3342	Negative	50	0,015
S-Lipoprotein (a)	Work support	,2977	Negative	50	0,032
S-Lipoprotein (a)	Friend support	,4427	Negative	50	0,001
	Sources of pressure in job				
S-Cholesterol	Hassles at work	,3460	Positive	53	0,010
S-Triglycerides	Bad work communication	,3117	Negative	54	0,019
S-LDL	Hard organization climate	,2682	Positive	54	0,046
S-LDL	Hassles at work	,3273	Positive	53	0,015
S-Lipoprotein (a)	Hard managerial role	,3007	Positive	53	0,026
	Rules of the game				
S-LDL	Bureaucracy	,3591	Positive	53	0,007

tions were related to the ruling of the organization, whether there were self-appointed leaders and whether the organization was experienced as chaotic.

The study was approved of the Ethical Research Committee of the Karolinska Institutet, Stockholm.

Results

The means of the total serum concentration of total cholesterol, LDLcholesterol and HDL cholesterol as well as of plasma fibrinogen could be compared to those of 5720 employed men and women who were representative of the working population in the greater Stockholm area (the WOLF study, Peter et al. 1998). Since two different laborato-

TABLE 7b
"Healthy" lipids. Significant partial correlations (p<=0,05). The correlations are adjusted for age.

Blood analyses	Index	Partial correlation = r	Direction of correlation	N	Significance = p
	Sources of pressure in job				
S-HDL	Bad work communication	,2772	Positive	54	0,039
	Rules of the game				
S-HDL	Bureaucracy	,3117	Negative	54	0,019

ries had performed the analyses they were not fully comparable. However, after having taken into account the possible differences in reference values the following tentative conclusions could be made: Total serum cholesterol and LDL did not differ between the studied managers and the normal working population of men in the WOLF. HDL and fibrinogen, on the other hand, tended to be higher in the managers than in the "normal" population. Thus while the managers were quite similar to the normal working male population with regard to total cholesterol and LDL, the differed in a beneficial direction with regard to HDL and in a harmful direction with regard to fibrinogen. On balance they were neither more healthy nor more ill working men in general.

Partial correlations have been analyzed and significant correlations (p=<0,05) are displayed in Table 7a-7c.

Discussion

In the present study a relatively small number of subjects was studied. Accordingly it was not meaningful to perform more complex statistical computations. An additional problem was the high attrition. This is to be expected in this kind of study because it is hard to motivate managers to participate in this kind of study. A low participation rate is of course deleterious to prevalence or incidence estimations. It is hard to see, however, how systematic errors would arise in correlation analyses of the present type, although conclusions should be cautiously drawn.

Nine blood parameters and 17 indices have been analyzed. Accordingly 153 correlations have been computed and 22 significant partial correlations (14%) were found on the 0.05 level, which is clearly, more than a random number of correlations. The analysis of biological plausibility is central to the analysis of the significant correlations. In this case most of the correlations do form a meaningful biological pattern.

TABLE 7c
P-Fibrinogen and S-Cortisol. Significant partial correlations (p<=0,05). The correlations are adjusted for age.

Blood analyses	Index	Partial correlation = r	Direction of correlation	N	Significance=p
	Psychosocial support				
P-Fibrinogen	Manager support	,3418	Positive	43	0,022
S-Cortisol	Work support	,3392	Positive	51	0,013
S-Cortisol	Good Network	,2906	Positive	51	0,035
S-Cortisol	Appreciation	,3180	Positive	51	0,020
	Sources of pressure in job				
P-Fibrinogen	Hard managerial role	,3057	Positive	47	0,033
S-Cortisol	Home/Work conflict	,3069	Negative	54	0,021
S-Cortisol	Hard managerial role	,3582	Negative	54	0,007
S-Cortisol	Bad recognition	,3372	Negative	54	0,011

Managers who experienced their organization as bureaucratic had high scores of *bureaucracy*. A low level of experienced bureaucracy correlated with high levels of the "healthy" HDL (Table 7b.). *Bad work communication*, however, is a source of pressure at work and this unexpectedly correlated positively with "healthy" HDL (Table 7b.). The communication pattern in a company could be seen as part of the corporate culture (Barnard 1938, Schein 1992). The result of *bad work communication* was however incongruent. After the exclusion of six subjects on medication or diet for elevated lipids there were no significant relationships between communication on one hand and triglycerides (p=,054) or HDL (p=,188) on the other hand.

LDL is a "harmful" lipid, and a high LDL concentration correlated positively with high levels of bureaucracy. Managers, who scored high in *hard organization climate*, *hassles at work*, and *hard managerial role* had higher levels of "harmful" lipids than others (Table 7a.). In relation to a big population (WOLF) the managers LDL was lower. *Hassles at work* were associated with cholesterol, and LDL. *Hard managerial role* and *hard organization* were associated with LDL and lipoprotein (a). Triglycerides are also "harmful,"

especially for women. The corresponding correlations in these male managers were incongruent with the female pattern (Table 7a). Controlling for elevated lipids any time changed the significance to non-significant and controlling for lipid medicine led to absolutely non-significance, in the same way as for HDL (p=,591). The mean level for HDL was higher in managers than in the population study WOLF.

Physical activity is known to be associated with low LDL and triglycerides (Spyckerelle et al. 1993) and with a high HDL concentration. In the present study, neither physical activity nor smoking changed any of the correlations with lipids significantly

Good psychosocial support, expressed in *good network*, *work support*, and *friend support*, seems to have a strong negative correlation with "harmful" lipids—cholesterol, LDL, apolipoprotein B, and lipoprotein (a). The latter statement was particularly relevant when there was a large social network and qualified support from colleagues as well as friends. The index *good network* was significantly correlated to four different "harmful" lipids (Table 7a).

A high serum cortisol reflects a high arousal level. High levels of serum cortisol correlated with high scores on *good network*, and *appreciation* (Table 7c). A very large social network as well as excessive appreciation may mean a high level of arousal, which is consistent with the findings in this study. High cortisol correlated positively with high sources of pressure—*hard managerial role* (Table 7c). The mean level of cholesterol was a little higher than in the population WOLF (Peter et al., 1998). Longlasting pressure conditions may be associated with low serum cortisol (Theorell 1997). There are correlations between low serum cortisol and high experience of *home/work conflict, hard managerial role* and *no recognition*. It is possible that these factors manifest more long-term stress, which is difficult to change. Exclusion of subjects with extreme values did not explain or change the correlations.

An imbalance between demands from homework and the demands at work can be hard to change. The same can be true with regard to high demands in the managerial role. Maybe it is necessary to leave the position or accept working in a lower position. It is not impossible that those effects could be due to long-term stress. This has to be analyzed in further studies.

Plasma fibrinogen was high when *manager support* was high, as well as when the participant judged that he had a *hard managerial role*. In the index *manager support* there are elements of authority and organization of work. Support from superiors may include demands to develop and organize the work better. In the long perspective, high *manager support* might lead to pressure in managers. This may be an aspect of psychosocial load that is more pronounced in managers than in others. This is in accordance with Siegrist et al. (1997), who found that chronic work-related strain could be an independent factor explaining changes in lipids and high levels of plasma fibrinogen in healthy middle-aged men. The managers in this study had a higher average plasma fibrinogen concentration than working men in general in Stockholm, according to the WOLF study (Peter et al., 1998). With regard to total cholesterol as well as HDL and LDL cholesterol there were no observable differences, on the other hand. Support from a large network did not have the same statistical effects on cortisol as on lipids. High psychosocial support showed an association with high serum cortisol. In the same way plasma fibrinogen correlated with high support from superiors.

Summary

In this study some correlations may seem inconsistent and contradictory, but there are more correlations that support the hypothesis that strain as well as corporate culture influence endocrinological status and lipids.

Good psychosocial support for male managers was consistently associated with low LDL and low lipoprotein (LDL/*good network* p=,002, lipoprotein (a)/*good network* p=,015, lipoprotein (a)/*friend support* p=,001). Pressure at work influenced the managers' endocrine status but in a way that is not consistent with studies of such associations in the general working population. The psychosocial support indices (*good network, work support, friend support, manager support,* and *appreciation*) are all related to the interplay between individuals. That may indicate that serum lipids in male managers are influenced in a healthy way by good social support. This could be due to the individual's way of acting or to support from the surroundings.

Corporate culture measured as "Rules of the Game" indicated that "bureaucracy" was significantly associated with high LDL and low HDL levels. The study also indicates that managers' lipid levels can be higher than in the population. Managers have special conditions and to what extent these are due to individual characteristics or organizational factors are unclear. The results also indicate that corporate culture measured by "Rules of the Game" is associated with health.

The interplay between lipids, cortisol and the effects of social support in an organizational context need to be analyzed in future studies. The present study was performed during a period of excessive changes in working-life. This was the case also in the participating companies. This may influence the results and it could be important to follow the participants over time. Further investigations may give important tools for intervention in working places.

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