Arh. hig. rada toksikol., **30** *(1979) suppl. pp. 1395–1406.*

PSYCHOSOCIAL PROBLEMS AND PSYCHOSOMATIC SYMPTOMS OF SHIFT AND DAY WORKERS

M. KOLLER
Institute of Environmental Hygiene, University of Vienna, Vienna, Austria

ABSTRACT

A field study was carried out in 270 male workers (171 permanent shift workers, 57 permanent day workers and 32 "drop-outs" = former shift workers). By means of questionnaires, rating scales and interviewer data about personal history, family relations, working conditions, job satisfaction, leisure time activities, state of health, risk factors and psychosomatic symptoms were collected.

No striking differences between day- and shift workers occurred with respect to risk factors like weight or consumption of alcohol, coffee and cigarettes. A pronounced irregularity in eating times and in eating habits during stress as well as a marked lower number of group sport activities were found in shift workers. A rather high amount of psychosomatic symptoms was reported by all groups, shiftworking people suffering especially from frequent fatigue and exhaustion and complaining about various allergic symptoms. Former shift workers (currently day workers) exceeded the others in cardiovascular complaints.

The state of health was positively correlated with job satisfaction and marital relations and negatively correlated with age and mental load. The correlation with age was significant for both groups, whereas all the other correlations were significant only for the shift workers. It is suggested that some shift workers may develop a reduced tolerance for additional stressors. The combination of risk factors in the working situation with risk factors in the general and social environment may lead in these workers to psychosocial complaints and psychosomatic symptoms.

The question to what extent and in which ways shift work directly affects the health of working people, is still in discussion. A considerable number of studies in this field have been performed[1,3,6,10,13,15]. The results of surveys dealing with subjective reported health problems and with medical and health statistics are inconsistent and partly even contradictory.

As one common baseline in this field of research one could take the knowledge about biorhythms of physiological functions and about difficulties in reentrainment of those functions during shift work. There exists also some agreement about underlying mechanisms of physiological and psychological disturbances[2,4,5,8].

Too little is still known about the individual differences involved in the capacity for adaptation to changed hours of work. Reasons for that seem to be

multidimensional and are to be traced from the physiological as well as from the sociological point of view. Adaptation is not only a matter of the workers' physical characteristics and the particular shift system and shift routine, it is also a matter of the individual's attitudes towards his specific work, to his working environment, to his housing and domestic circumstances, to the attitudes of his wife and family and to his leisure habits. The aim of the study reported here was to look for specific somatic and/or psychosocial risk factors which could be connected with the varying health problems of day- and shift workers and in particular with differing degrees of health problems within the shift workers' population.

METHODS

The field study was carried out in an oil refinery, where 270 male workers out of a total labour force of 1000 were interviewed. Workers were divided firstly into day workers without any shift experience (permanent day workers, N = 57), secondly into workers, who had dropped out of shift work for different reasons and had changed to day work within the plant ("drop-outs", N = 32) and thirdly shift workers, who for the most time had worked in shifts (permanent shift workers, N = 171). A division into shift systems proved to be pointless since the vast majority of subjects were working in a rapidly rotating, continuous 3-shift-system with a 16-week cycle. Within the groups people were selected at random. Participation was voluntary, interviews were anonymous. Thanks to the support of the management and the representatives of the work force the rate of participation was about 85%. A questionnaire was given to the employees by members of the labour unions to whom the workers had to return it after one week. Following this each worker was interviewed within the factory. The questionnaire contained items about personal and family data, working and workplace conditions, job satisfaction, attitudes towards work and shift work in general, about family life and social activities. A personal interview checked health risk factors and sleep characteristics as well as influences of biorhythms and morning-evening types. Questionnaires and interview items were partly developed by ourselves and partly based on validated items taken from the literature[7,11,12,14].

Questions were coded on the questionnaire and interview sheet so that they could, after further checking, be fed directly in the computer for data analysis. Data were statistically analysed by χ^2-tests (comparison of frequencies) and T--resp. U-tests (comparison of test scores). As correlation criteria for two graded variables Goodman-Kruskals t was used.

RESULTS

Workers were comparable by age, years of employment and education. Income levels differed significantly between the groups. Permanent shift workers had higher income levels than drop-outs and those had higher incomes than day workers. Marital status, number of children and family members were similar in

all groups. One interesting result was, that noise induced sleep disturbances occurred most frequently in shift workers and least frequently in permanent day workers. The "drop-outs" reported more sleep disturbances than day workers, but less than shift workers.

Workplace conditions (noise, air pollution, temperature, wetness) were described as moderately disturbing in all groups. More detailed information about these results is to be found in a former publication[9].

In the medical part of the study the workers were interviewed about health complaints as well as disorders and diseases of different functional systems. The frequency of medical consultations, drug intake and hospitalization was registered. These items were rated by a physician and ranked on a scale with the range of scores from 0 to 100. The score of 100 was defined as being equivalent to the health optimum. The health score for each person was independently rated by two people with similar results.

Table 1 shows the different health scores for day workers, drop-outs and shift workers. Permanent day workers were found to have the best health score whereas permanent shift workers exhibited the worst one. Drop-outs had intermediate values. Since there existed no statistically significant differences it is unlikely that the different health scores were caused by different age

TABLE 1
Average health scores (100% = optimal health).

		$\bar{x}$ S.D.	Significance t-test
Day workers	without shift experience = permanent day workers	84.91 (±22.35)	t = 3.21
	with former shift experience = "drop-outs"	76.45 (±27.87)	
Shift workers	without day experience = permanent shift workers	72.02 (±27.36)	

distributions. To test this further a correlation between health score and age was computed. Figure 1 indicates, that undoubtedly there exists a negative correlation between health score and age. But this negative correlation occurs equally in day workers and shift workers. Independently of this negative correlation day workers have better health scores than the shift workers in all age groups.

Experience of shift work would be expected to be related to accumulation of health problems even if the process of self-selection of shift workers is taken into account. However, we did not find a relationship between health score and years of shift experience.

The interview included additional questions about health risk factors, which are listed in Table 2.

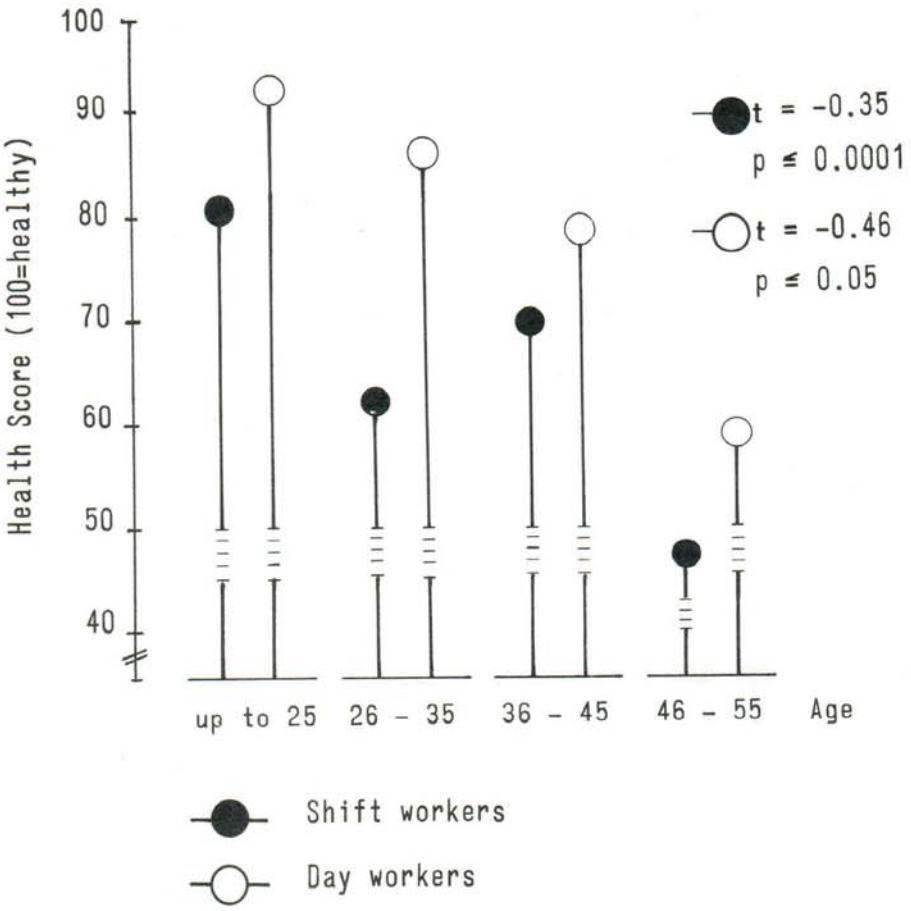

FIG. 1 – Health rating and age. A comparison between permanent day workers and permanent shift workers.

We did not find any differences between the groups concerning weight and consumption of alcohol and cigarettes. Regular need for coffee was slightly higher in current shift workers and in former shift workers. As for regular eating hours significant differences between the groups were found. As may be expected, shift workers have difficulties in keeping regular eating hours. However, the outstandingly differing eating habits of people during stress seem to be of interest: over 60% of shift workers and drop-outs stated to alter their usual eating habits in exciting or irritating situations in terms of eating in haste or eating nothing at all. Since a lack of physical training can be considered as a health risk factor, different leisure time activities were examined. Passive leisure habits like watching TV, relaxing etc. were frequently cited by all workers.

TABLE 2
Health risk factors. A comparison between permanent day workers, "drop-outs" and permanent shift workers.

	Day workers (d)	Drop--outs (o)	Shift workers (s)	Significance ($p<0.05$)
Weight (kp)	74.4	76.0	79.5	N.S.
Height (mm)	1738	1739	1761	N.S.
Regular consumption of alcohol*	66.7	53.1	59.6	N.S.
Regular smoking cigarettes*	59.6	56.3	55.0	N.S.
Regular drinking coffee*	77.2	87.5	81.9	N.S.
Regular eating hours*	73.7	90.6	26.0	d-s,o-d,o-s
Change of eating habits in stress*	48.2	60.9	67.2	d-s,o-d,o-s
Sports in groups*	21.1	6.2	5.3	d-s

*in per cent of workers

Significant differences occurred with respect to sport activities performed in groups. A very small percentage of shift workers takes part in team sport activities. Individual sport activities showed no significant differences.

Frequently mentioned psychosomatic symptoms are listed in Table 3. A significantly higher proportion of shift workers reported to be frequently fatigued and exhausted and to suffer from various allergic symptoms; drop-outs especially complained of cardiovascular symptoms. Generally a high percentage of people stated to be very sensitive to changes of the weather and to suffer from perspiration.

TABLE 3
Psychosomatic symptoms. A comparison between permanent day workers, "drop-outs" and permanent shift workers.

	Percentage of workers			Significance Z^2-test($p<0.05$)
	Day workers (d)	Drop-outs (o)	Shift workers (s)	
Frequent headaches	14.0	18.8	21.9	N.S.
Frequent colds	21.0	6.1	21.4	o-s
Frequently fatigued and exhausted	8.8	9.4	25.5	d-s,o-s
Meteorosensitivity	35.1	43.8	40.0	N.S.
Various allergic symptoms	19.3	6.3	32.5	o-s
Tachycardia	8.8	18.8	19.5	N.S.
Pain in the chest	12.3	25.0	23.7	N.S.
Pain radiating into the arm	10.5	9.4	13.6	N.S.
Angina pectoris	10.5	15.6	10.7	N.S.
Dyspnoea	7.0	15.6	10.7	N.S.
Night sweats	19.3	15.6	24.3	N.S.
Perspiration	35.1	31.3	42.6	N.S.

TABLE 4
Frequency of doctors' consultations and work-related complaints. A comparison between permanent day workers, "drop-outs" and permanent shift workers.

	Percentage of yes-answers			Significance χ^2-test
	Day workers	Drop-outs	Shift workers	
Do you consult your doctor too seldom? According to:				
own opinion	71.9	71.9	66.3	N.S.
opinion of the family	73.7	81.3	70.4	N.S.
Would regular day work be better for the sake of your health?	96.5	93.8	75.7	–
Less health complaints after a change to day work	–	–	46.74	–

Opinions about the necessity of doctors' consultations and frequencies of work-related complaints are shown in Table 4. Obviously many workers think that they consult the doctor too seldom, but there is no significant difference between the groups.

Our study further comprised connections between health scores and different other variables, like job satisfaction, work load and family relations.

Job satisfaction was measured by Neuberger's ABB test[12]. Kunin items were used as indicators for high and low job satisfaction. A comparison between the scores for job satisfaction and the sum scores for physical and mental work load between day workers, drop-outs and shift workers is drawn in Table 5. In all variables no significant differences were found between the three groups. There is a slight tendency for shift workers to rate their mental work load higher than day workers do.

Figure 2 illustrates that the health scores decreased with decreasing job satisfaction. This correlation was statistically verified for shift workers, but not

TABLE 5
Rated mental and physical work load and job satisfaction. A comparison between permanent day workers, "drop-outs" and permanent shift workers.

	Mean values and standard deviations			Significance t-test
	Day workers	Drop-outs	Shift workers	
Mental work load (100 = max. load)	47.98(±21.2)	55.34(±22.3)	59.06(±21.3)	N.S.
Physical work load (100 = max. load)	53.04(±20.0)	42.25(±17.7)	50.95(±21.6)	N.S.
Job satisfaction (900 = max. satisfied)	316.4(±38.5)	299.9(±41.6)	290.9(±53.4)	N.S.

for day workers. With regard to mental work load and health, only shift workers showed significant correlations (Fig. 3).

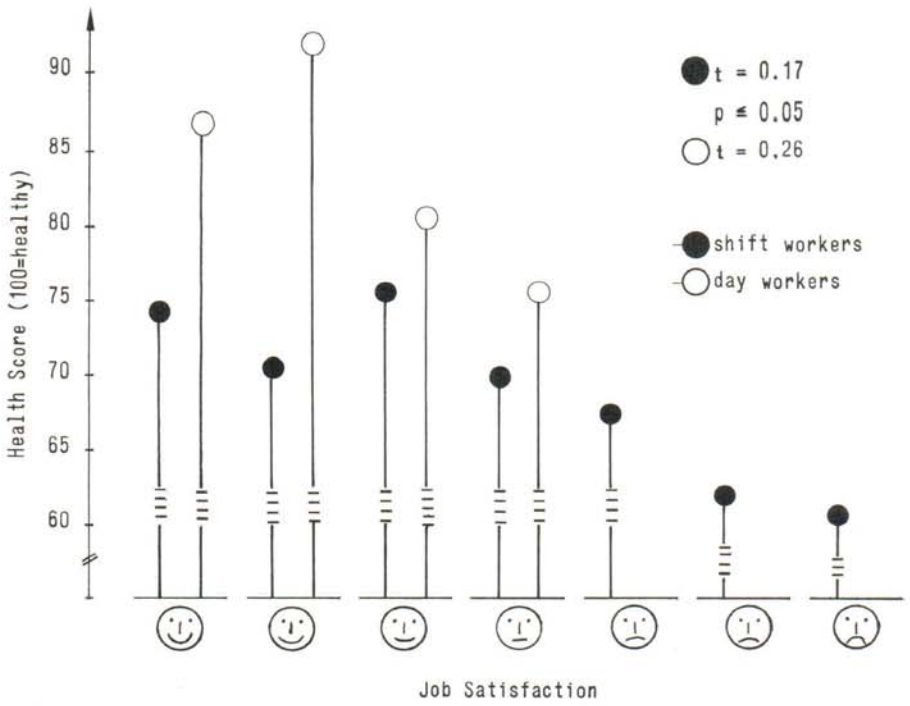

FIG. 2 – Health rating and job satisfaction. A comparison between permanent day workers and permanent shift workers.

Regarding the shiftworking population, a top health score coincided with a moderate mental load whereas a very high as well as a low mental work load seem to be connected with lower health scores. Day workers show a different relation between mental load and health, especially at the upper end of the scale. Even day workers with very high mental load ratings had about the same health score as the ones with low and medium mental loads.

By means of a validated questionnaire taken from the literature[11], different problems in family life and interpersonal relations have been checked. Figure 4 indicates some of the main items to which the answers of day workers and shift workers were significantly different. Compared with day workers, a significantly higher percentage of shift workers stated that they could spend only little time with their wives, that their wives often felt lonely and that there existed sexual problems. A harmonious family life despite these difficulties seemed to be maintained by shift workers similar to day worker families.

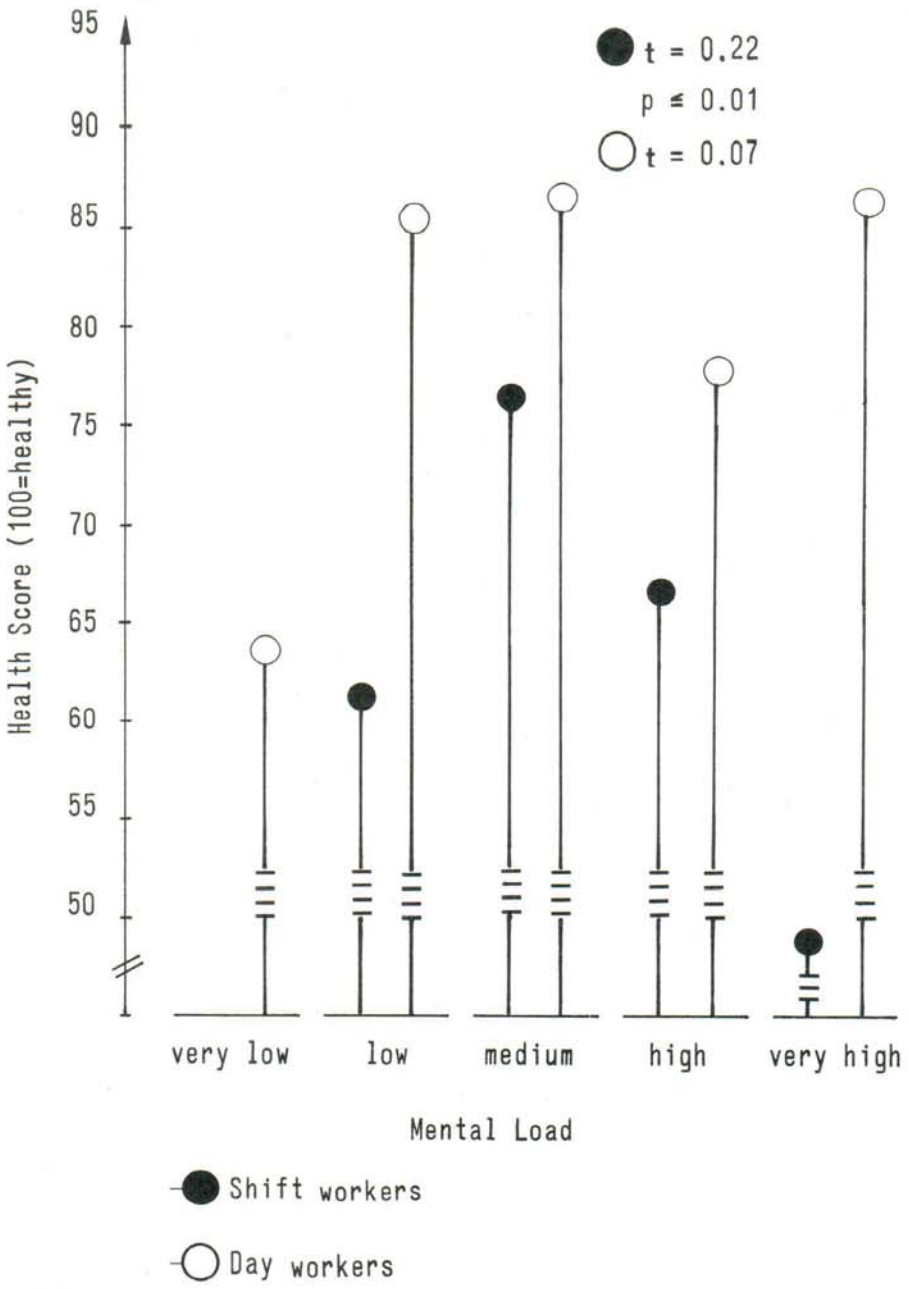

FIG. 3 – Health rating and mental load. A comparison between permanent day workers and permanent shift workers.

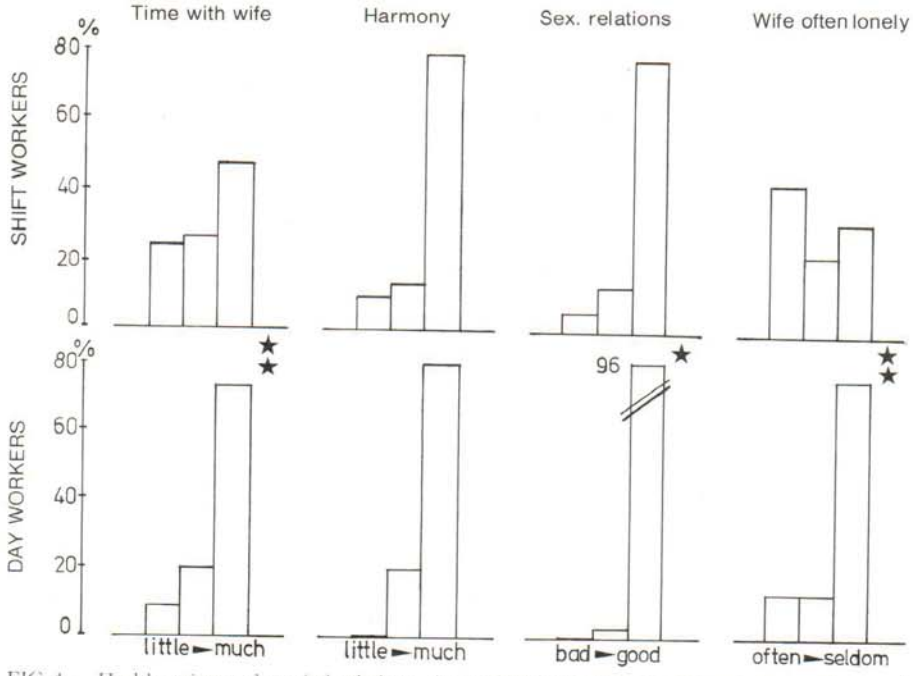

FIG 4 – Health rating and marital relations. A comparison between permanent day workers and permanent shift workers.

*significant at the 5% level
**significant at the 1% level

Looking at the possible connections between health scores and merital relations, a clear positive correlation was found in shiftworking people, as demonstrated in Figure 5. Again no significant correlations could be calculated for day workers or drop-outs.

DISCUSSION

For equal work loads, resistance to shift work varies with the individual workers, as has been shown in morbidity statistics. As age and shift-experience do not suffice to explain these individual differences, physiological and psychological factors may account for it. In this context it seems important to try to identify the environmental and social factors which may be responsible for additional negative health effects. We succeeded in finding relationships between some psychosocial stimuli and health, as for instance positive correlations between job satisfaction or marital relations and state of health. Regarding the shiftworking population, the top health score is found under the condition of medium mental work load[14]. A very high as well as a low mental load seem to be connected with lower health scores. This kind of relation between work load and

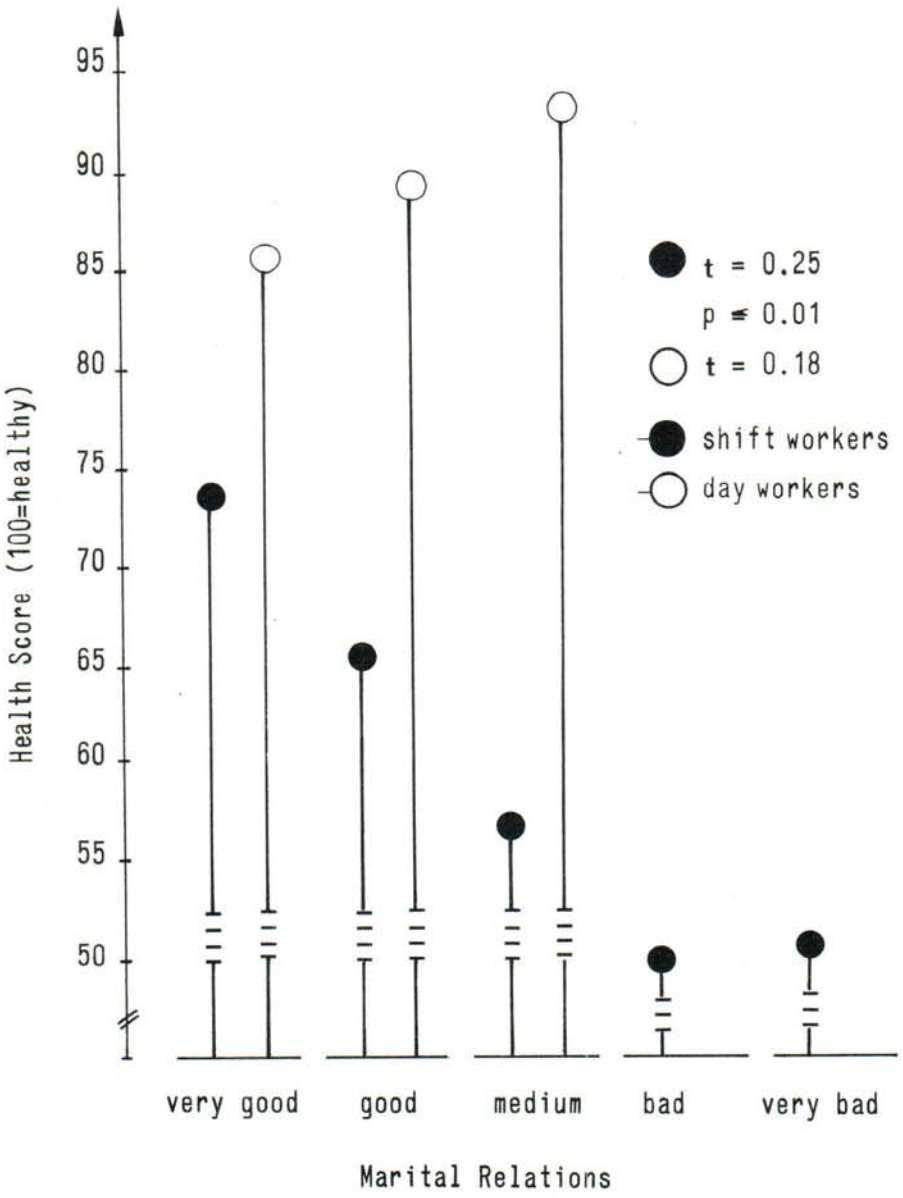

FIG. 5 – Statements of permanent day workers and permanent shift workers with regard to marital relations.

health may reflect one of the newer stress concepts, according to which understimulation as well as overstimulation are expected to induce disturbances in body functions. Similar principles have long been applied in the field of fatigue and activation. How cautious one must be in the application of such concepts is demonstrated by the fact that day workers do not reflect such a relation between mental load and health. One interpretation would be that shift work as a further stress accentuates the stress of mental load and that these "combined stressors" lead to the very low health scores at the upper end of the mental load scale for shift workers.

According to our results we may conclude that with respect to health shift workers have to be taken as a risk group. It seems to us, however, that health problems arising in the course of shift experience is to a certain extent not directly due to workplace and working conditions per se, but can be attributed to various social and psychological stressors.

As a number of correlations proved to be significant mainly in the shift worker's population, we may put forward the hypothesis that psychosocial stressors – as long as they are not outstandingly high – can be tolerated by people whose living circumstances and working conditions are favourable. As soon as people are forced to work and live under conditions with tension and strain, additional psychosocial stressors might not be tolerated any longer and will lead to health complaints and disorders. Such mechanisms could be responsible for many psychosocial complaints and psychosomatic symptoms of night and shift workers.

REFERENCES

1. *Akerstedt, T.* Interindividual differences in adjustment to shiftwork. Proceedings of the 6th International Ergonomic Association, University of Maryland 1976, 510–514.
2. *Aschoff, J., Wever, R.* Spontanperiodik des Menschen bei Ausschluß aller Zeitgeber. Naturwissenschaften, **49** (1962) 337–342.
3. *Carpentier, J., Cazamian, P.* Night work. International Labour Office, Geneva 1977, 13–40.
4. *Colquhoun, P., Folkard, S., Knauth, P. and Rutenfranz, J.* Experimental studies of shiftwork. Proceedings of the 3rd International Symposium on Night- and Shiftwork, Dortmund 1974, Opladen Verlag, 1975.
5. *Halberg, F., Vischer, M.B.* Some physiologic effects of lightning. Proceedings of the 1st International Photo Biological Congress, Amsterdam 1954, 396–398.
6. *Haider, M., Cervinka, R., Höller, H., Knapp, E., Koller, M., Kundi, M., Neuberger, M., Schmid, H.* Gesundheitliche und soziale Aspekte der Schichtarbeit. Schicht- und Nachtarbeit, Mitteilungen des Institus für Gesellschaftspolitik, **20** (1976) 45–66.
7. *Horne, J. A., Östberg, O. A.* A self assessment questionnaire for the measurement of behavioural correlates of morningness-eveningness in circadian rhythms. Unpublished Report, Dept. of Human Sciences, University of Technology, Loughborough, London, 1975.
8. *Knauth, P.* Kriterien für die Beurteilung verschiedener Schichtwechselformen. Thesis, Darmstadt 1975.
9. *Koller, M., Kundi, M., Cervinka, R.* Field studies of shift work at an Austrian Oil Refinery. I: Health and Psychosocial Wellbeing of Workers who Drop Out of Shift Work. Ergonomics, **21** (1978) 835–849.
10. *Maurice, M.* Shiftwork. International Labour Office, Geneva 1975.

11. *Mott, P.E., Mann, F.C., Mc Loughlin, Q. and Warwick, D.P.* Shift work. The social, psychological and physical consequences. The University of Michigan Press, Ann Arbor, Michigan 1965.
12. *Neuberger, O.* Der Arbeits-Beschreibungs-Bogen. Ein Verfahren zur Messung der Arbeitszufriedenheit. Problem und Entscheidung, Heft 15. Blasaditsch GmbH., Augsburg 1976.
13. *Rutenfranz, J., Colquhoun, W.P., Knauth, P. and Ghata, J. N.* Biomedical and psychosocial aspects of shift work. Scand. J. Work Environ. Health, **3** (1977) 165–182.
14. *Rutenfranz, J.* Questionnaire for Air Traffic Controllers. Unpublished.
15. *Sergean, R.* Managing Shiftwork. Gower Press, 1971, p.p. 171–195.