Expression and fluctuation in fatigue over five consecutive night shifts

緒方, 文子

https://doi.org/10.15017/1866265

出版情報：九州大学, 2017, 博士（看護学）, 課程博士
バージョン：
権利関係：

Original

Expression and Fluctuation in Fatigue Over Five Consecutive Night Shifts

Ayako Ogata[1)2)] and Yoko Hatono[3)]

[1)]Department of Health Sciences, Graduate School of Medical Science, Doctor's Course, Kyushu University

[2)]Department of Community Health Nursing, Oita University of Nursing and Health Sciences

[3)]Department of Health Sciences, Graduate School of Medical Science, Kyushu University

(Received: January 13, 2017. Rapid publication)

Abstract

Objectives: We aimed to perform a survey of diurnal and chronic fatigue arising from nighttime and daytime work among individuals performing nighttime work for 5 consecutive workdays followed by a week of daytime work for 5 consecutive workdays. We also investigated the factors that affect diurnal and chronic fatigue fluctuations.

Methods: A survey of 94 male workers from the manufacturing industry was conducted. The self-administered questionnaire comprised the Jikaku-sho Shirabe (to evaluate basic attributes and diurnal fatigue) and the Roudousya no Hirouchikusekido Checklist (to evaluate chronic fatigue). To investigate chronic fatigue, daily surveys were completed before work on the first day of the survey. To investigate diurnal fatigue, daily surveys were completed before and after work on the first day of work following a day off.

Results: The average age of the 38 subjects who worked five successive night shifts was 27.8 years, and their average length of employment at the time of the study was 63.1 months. Comparing diurnal fatigue scores between nighttime and daytime work, the scores for daytime work were high before starting work following a day off, and the scores for the night shift were high on all days after work. In particular, a significant difference in drowsiness was seen on all days. The fluctuations remained almost the same between the night shift and day work. There were 22 people with high levels of chronic fatigue, and their diurnal fatigue scores were low.

Discussion: Fatigue fluctuations during night shifts and day work are believed to be nearly identical because of the formation of unique weekly rhythms due to regular shift effects. However, from these results, it was reaffirmed that five successive night shifts is never a desirable work regime. We considered that those with high levels of chronic fatigue are desensitized to daily fatigue as they have become accustomed to work, and, in particular, they are desensitized to their fatigue during night shifts.

(JJOMT, 65: 190—200, 2017)

—Key words—

consecutive night shifts, fatigue, subjective symptoms

Introduction

With the recent shift in the work pattern of society to a 24-hour work schedule, a total of 18.6% of Japanese workers are now involved in shift-based work, of which 9.2% work night shifts[1)]. Individuals engage in night shift work during the time that is meant for sleep, which leads to various mental and physical problems[2)]. In response to this situation, the Rutenfranz Principle[3)], which is the global standard for shift system work (including nighttime work), states that nighttime work should be kept to a minimum. Thus, the National Institute for Occupational Safety and Health[4)] and the International Labor Organization Recommendation Article No. 178[5)] provide recommendations regarding nighttime work. In addition, the Shift Work Committee of the Japan Society for Occupational Health[6)] states that nighttime work should be limited to one night only, and, if un-

avoidable, to only 2 or 3 nights in succession. However, in reality, many workplaces require regular nighttime work owing to the economy, technology, and public nature of the work, among other reasons.

A survey focusing on the subjective symptoms of night shift workers and shift workers in general clearly indicated that awareness towards fatigue increases with the continuation of labor, along with an increase in chronic drowsiness[7].

In addition, surveys on individuals working consecutive night shifts have indicated the occurrence of fatigue after 4 and 5 days[8)–11)]. An additional survey has also described the number of accidents occurring over 4 consecutive night shifts. These studies indicate that fatigue and the risk of accidents increases with time, and hence the physical burden may be lessened by providing a day off after each 2-day interval. The fatigue caused by working night shifts may become chronic shortly after the individuals experience diurnal fatigue[12]; moreover, chronic fatigue may lead to health problems if left untreated. Hence, it is essential to understand the conditions of both diurnal and chronic fatigue over consecutive night shifts.

Previous studies have examined fatigue in the medical and social service industries; however, the nature of the work, and work patterns in these industries may limit the generalization of previous results to other industries. In addition, as the nature of work tasks or the number of persons employed varied during the study period, the effects of the working conditions or attributes were not excluded in previous reports[13)–15)]. Therefore, in the present study, we examined diurnal and chronic fatigue arising from nighttime and daytime work in the manufacturing industry, in which an excess of 10 million of the 64.32 million employed individuals in Japan work[16].

Materials and Methods

Definition of terms

1. Fatigue: Physical or mental activity causing a decline in physical and mental function, which is accompanied by subjective symptoms such as drowsiness, dullness, difficulty focusing, and physical discomfort (such as stiff shoulders).

2. Diurnal fatigue: Fatigue resulting from activity over a single day that can be resolved by sleeping (1 session of sleep).

3. Chronic fatigue (accumulated fatigue): Fatigue caused by activity over a single day that cannot be resolved by sleeping, and is subsequently carried over to the following day. The repetition of this condition over consecutive days leads to the accumulation of fatigue.

4. Consecutive night shifts: Work performed late at night (such as between 10 p.m. and 5 a.m.) that is continued over 2 or more days.

Definitions 1 to 3 are based on definitions in the 2003 Roudousha no Hirouchikusekido Jikoshindan Checklist[17], published by the committee of the Japan Industrial Safety & Health Association, whereas definition 4 is based on the Labor Standards Act.

Research Methods

Study design

The study consisted of a survey where participants completed a self-administered questionnaire.

Study participants

Participants consisted of 94 male staff working in the manufacturing industry, who worked consecutive night and day shifts on an alternating basis during the data collection period.

Data collection period

Data were collected from November 18 to December 14, 2013, when changes in personnel and position were likely to be limited.

Data collection methods

The demographics of the workers, as well as the descriptors of chronic fatigue, were surveyed before the start of work on the first survey day. This timing was needed because we hypothesized that measuring chronic fatigue after the occurrence of diurnal fatigue would sensitize the subjects to the surveys of fatigue, bi-

	Week1							Week2							
Time	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Time
1															1
2															2
3															3
4		Durnal	Durnal	Durnal	Durnal	Durnal									4
5															5
6															6
7								Durnal							7
8															8
9															9
10															10
11															11
12															12
13															13
14															14
15															15
16															16
17	Chronic							Durnal	Durnal	Durnal	Durnal	Durnal			17
18	Durnal														18
19															19
20															20
21															21
22															22
23															23
24															24

Fig. 1 Work schedule

Night time shift 7PM to 4AM, Day time shift 8AM to 5PM

Chronic fatigue were surveyed before the start of work on the first survey day.

Daily surveys were performed before work on the first day of work following a holiday, and after work during the other days.

asing their current state. To investigate events that influence diurnal fatigue and fatigue recovery, daily surveys were performed before work on the first day of work following a day off, and after work during the other days. The distribution and collection of surveys was performed by research representatives on the first day of the survey, and on the first day of work after a day off, with a placement method used on other days.

The sample population in the present study had a regular work schedule, wherein subjects alternately worked 5 consecutive night and day shifts with 2-day weekends (Fig. 1). However, as occasional non-consecutive work sessions due to business trips, vacations, and unexpected breaks were expected, we surveyed the same workers for a total of 4 weeks of observation (2 weeks of night shifts and 2 weeks of day shifts).

Survey content

(1) Demographics

These parameters included age, work experience, length of time working the night shift at the present job, mean sleep duration over the night shift and day shift periods, use of sleep medication, whether they lived with family member(s) who required care or child care, cigarette smoking and alcohol consumption, and medical history.

(2) Subjective symptoms of fatigue

① Diurnal fatigue

We used the Jikaku-sho Shirabe[18] questionnaire to evaluate diurnal fatigue. This is a typical questionnaire to investigate subjective symptoms of fatigue, and was created with the objective of capturing changes in work-related fatigue over time[18]. Both the reliability and validity of the questionnaire have been verified by the author of the survey. This is a representative questionnaire that examines the subjective symptoms of fatigue and includes 25 questions divided into 5 categories: group I, drowsiness; group II, instability; group III, uneasiness; group IV, dullness; and group V, eyestrain. Based on the intensity of the subjective symptoms such as drowsiness and dullness, one of the following answers was selected: “completely disagree,” “scarcely agree,” “slightly agree,” “considerably agree,” and “strongly agree,” (scored from 1 to 5); accordingly, the overall responses were summed and ranged between 25 to 125. Higher scores indicate a greater amount of fatigue.

② Chronic fatigue (Accumulated fatigue)

The Roudousha no Hirouchikusekido Jikoshindan Checklist[19] was used to evaluate chronic fatigue. This checklist was created for workers to self-check accumulation of fatigue during the previous month. Its reliabil-

ity and validity have been verified by the original research group[17].

This checklist comprehensively determines the accumulation of fatigue due to work, considering both subjective symptoms, and work conditions over the most recent month. The findings are presented as the degree of burden from work. Regarding subjective symptoms, participants answered 13 questions with responses including "irritated" and "anxious" (scores of 0–39) at levels of "hardly ever," "sometimes," and "often"; accordingly, the overall score was evaluated. In addition, work conditions were evaluated using 7 questions, such as "the amount of overtime in 1 month" and "the burden associated with late night shift work" (scores of 0 to 15). Although the scoring changed depending on the question item, the evaluation is based on the total score. The overall judgment of the work load is based on scores of subjective symptoms and the work situation, ranging from 0 to 7. There are four levels to the evaluation, with scores of 0 and 1 being "low," 2 and 3 being "somewhat high," 4 and 5 being "high," and 6 and 7 being "very high". A score of 2 to 7 represents the possibility of fatigue accumulation.

(3) Presence/absence of events affecting the recovery from fatigue

To understand factors outside of work that affect fatigue, the subjects answered the question "was there an event on the previous day that impacted your recovery from fatigue?" with a yes or no answer. If the answer was yes, the subject was asked to describe the event.

Data analysis methods

The Wilcoxon signed-rank test was used to examine differences in diurnal fatigue between nighttime and daytime work for each workday. Two-way analysis of variance (ANOVA) was used to examine differences in diurnal fatigue fluctuations between nighttime and daytime work across days. When assumptions of sphericity were violated, adjustments were made based on Greenhouse-Geisser, and Huynh-Feldt procedures. In addition, in order to grasp the characteristics of those with high chronic fatigue, they were divided into two groups: one with fatigue scores of 0 or 1 (the low chronic fatigue group) and the other with fatigue scores ranging from 2 to 7 (the high chronic fatigue group). The Mann-Whitney U test was performed to examine group differences.

For all analyses, SPSS Statistics software (version 23.0) was used, and a p-value less than 0.05 was considered significant.

Ethical considerations

We described the objectives and methods of the research study, as well as the methods for protecting personal information, and explained the intention of the joint research to all prospective participants. The following components were explained to the participants in written form on the first day of the survey: research objectives, voluntary nature of participation, and protection of privacy; the fact that there would be no repercussions from not consenting to this research, that participants were able to withdraw from the research after it began, and that data would not be used for purposes other than research; and the methods for storing questionnaires and input data. A written informed consent document was obtained from each participant. This study was approved by the Junshin Gakuen University Bioethics Committee, with which the research representative was previously affiliated (Approval Number 8).

Results

1. Summary of subjects (Table 1)

The questionnaires were distributed to 94 participants and all were recovered. Twelve individuals who worked for less than 5 consecutive days because of a business trip, vacation, or unexpected break, as well as 44 individuals who worked for more than 5 consecutive days, were excluded. Thus, a total of 38 subjects who did not have any missing data and worked 5 consecutive night shifts followed by a 5-day consecutive day shift work week were included. The mean subject age was 27.8 ± 8.4 years, and their average work experience at the present workplace was 63.1 ± 38.2 months. The average length of time for which they were engaged in night shift work was 51.2 ± 32.8 months. The mean frequency of sleep during night shift work was 1 to 3 times, whereas the mean length of sleep during night shift work was 370.8 ± 71.0 minutes. None of the workers regularly used sleep medication (Table 1). Only 1 subject reported an event that affected fatigue recovery (a long stretch of playing pachinko).

Table 1 Basic attributes

n = 38

	Range	Mean ± SD
Age (years)	19–53	27.8 ± 8.4
Duration of employment (months)	4–116	63.1 ± 38.2
Duration of nightshift (months)	3–106	51.2 ± 32.8
Mean duration of sleep during the nightshift (min)	240–540	370.8 ± 71.0
Mean duration of sleep during the day shift (min)	180–480	377.1 ± 67.6
		n (%)
Mean sleep frequency during the night shift		
Once		21 (55.3)
Twice		15 (39.5)
Thrice		2 (5.2)
Regular use of sleep medication		
Yes		0 (0)
No		38 (100)
Family member (or room/housemate) who required care and child care		
Yes		9 (23.7)
No		29 (76.3)
Smoking		
Yes		20 (52.6)
In the past		3 (7.9)
Never		15 (39.5)
Drinking		
Yes		17 (44.7)
No		21 (55.3)
Medical history		
Yes		4 (10.5)
No		34 (89.5)

2. Diurnal fatigue fluctuations during nighttime and daytime shifts (Fig. 2)

The diurnal fatigue score prior to starting work on the first day of work after a day off was higher for daytime work compared with that for nighttime work on all measured subscales. For the Group I drowsiness feeling, and Group V blurriness feeling, significant differences between nighttime and daytime work were observed ($p<0.01$ and $p<0.05$, respectively).

For diurnal fatigue assessed after work, the fatigue score was higher for nighttime work compared with that for daytime work on all days, with a significant difference on Day 1 and Day 2 ($p<0.01$ and $p<0.05$, respectively). In the measuring subscale, the Group I drowsiness feeling and Group III uneasiness feeling were higher for nighttime work compared with those for daytime work on all days, while the Group II unstable feeling and Group IV droopy feeling on Day 3 and later were higher for daytime work compared with those for nighttime work. For the Group I drowsiness feeling, a significant difference between nighttime and daytime work was observed on all days, while among the other feeling groups, a significant difference was observed only on Day 2 for the Group V blurriness feeling ($p<0.05$).

The total fatigue score peaked on Day 3 for both nighttime and daytime work. In the measuring subscale, with the exception of the first day of nighttime work for the Group IV droopy feeling, both the nighttime and daytime work were in the latter half from Day 3 onwards.

In terms of score fluctuation, aside from the daytime work Group II unstable feeling, the total score in the measuring subscale showed no mutual interaction between nighttime and daytime work, and the pattern of fluctuations was the same (results not shown in Table 1).

3. Characteristics associated with chronic fatigue

The low chronic fatigue group comprised of 16 subjects (42.1%), whereas the high chronic fatigue group comprised of 22 subjects (57.9%). Notably, the mean age of the subjects in the high chronic fatigue group was 4 years older, work experience was 12 months longer, and the duration of night shift work for these individuals was 17 months longer; however, the differences were not significant. The mean sleep duration was 385.6 min-

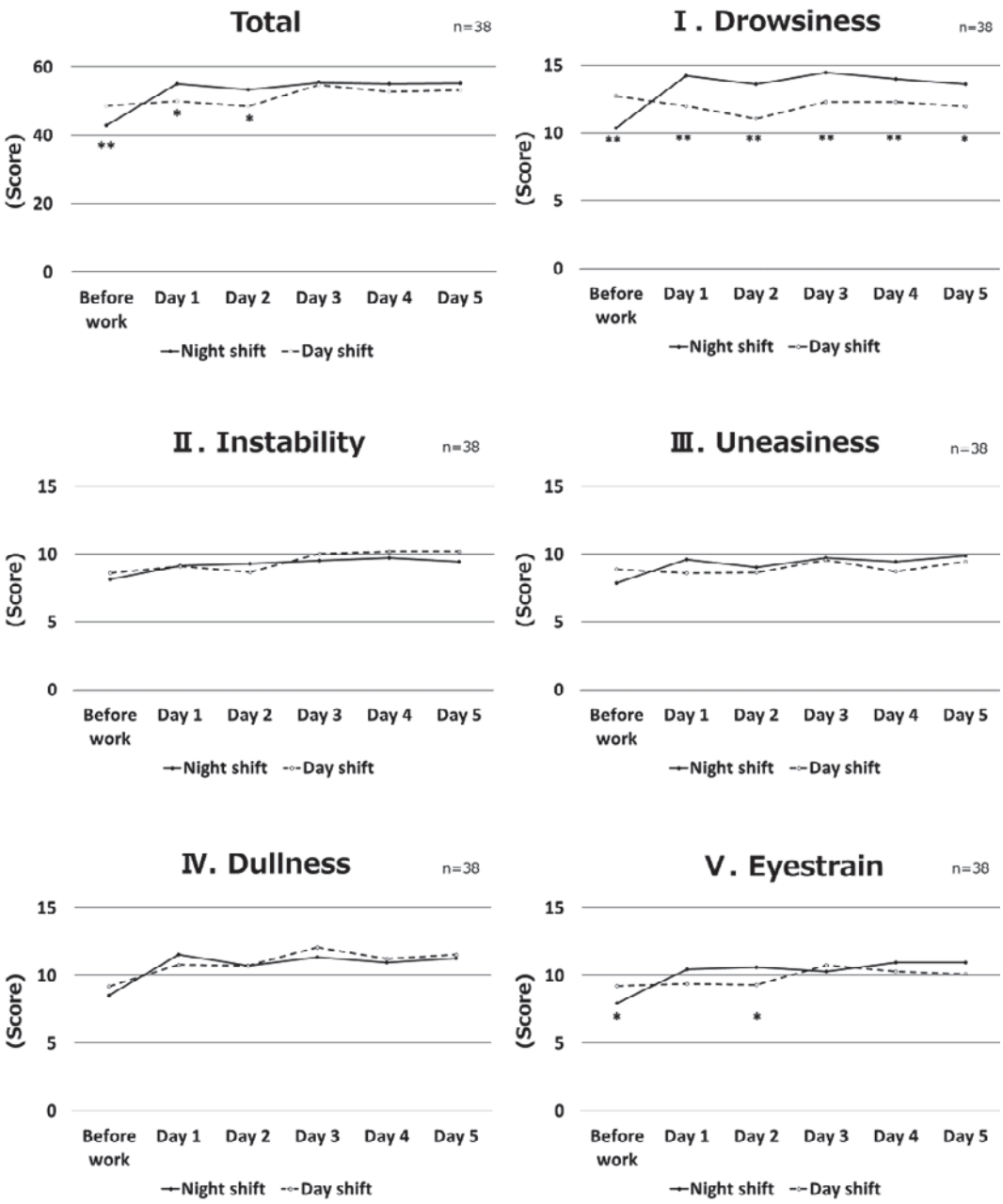

Fig. 2 "Jikaku-shoshirabe" The scores of the five categories
Wilcoxon signed-rank test, *p<0.05, **p<0.01

utes for the night shift workers and 386.3 minutes for the day shift workers in the low chronic fatigue group. In contrast, the mean sleep duration was 360.0 minutes for the night shift workers and 370.5 minutes for the day shift workers in the high chronic fatigue group although this difference was not significant. The mean diurnal fatigue score was higher in the low chronic fatigue group, both for night and day shift workers; however, only the score of the night shift workers was significantly different compared with that for day shift workers ($p<0.05$; Table 2).

Discussion

1. Diurnal fatigue caused by working the night shift

The diurnal fatigue score following 5 consecutive night shifts in the current study population was highest (55.3) on the third day, which is lower than that reported for nurses (71.2)[13] and care workers (special care nursing home, 72.5; nursing care facility for the elderly, 72.0; group home, 87.0)[14] who participated in a similar sub-

Table 2 Diurnal fatigue and personal attributes related to chronic fatigue

n = 38

	Low chronic fatigue group (n = 16)	High chronic fatigue group (n = 22)	p value
Age (years)	25.4 ± 3.4	29.6 ± 10.1	n.s.
Duration of employment (months)	56.1 ± 38.7	68.1 ± 36.1	n.s.
Duration of nightshift (months)	41.1 ± 30.6	58.5 ± 31.7	n.s.
Mean duration of sleep during the nightshift (min)	385.6 ± 69.7	360.0 ± 68.3	n.s.
Mean duration of sleep during the day shift (min)	386.3 ± 65.3	370.5 ± 66.9	n.s.
Diurnal fatigue score during the nightshift	62.6 ± 19.5	48.9 ± 18.5	*
Diurnal fatigue score during the day shift	58.0 ± 20.6	47.4 ± 17.7	n.s.

Mann-Whitney−U test *$p < 0.05$

jective symptom survey. One possible reason for this discrepancy may concern differences in the quality of the tasks, and the nature of the work. The work performed by nurses and care workers in the medical and social service fields have an effect on life and death[20], and such workers are constantly under stress[21]. Furthermore, the tasks among shifts, personnel, and night shift work patterns are irregular. In addition, as 93% of nurses are female[22], the role played by women in the home, such as housework, childrearing, elderly nursing care, and so on, may also affect fatigue. In contrast, the current study population had the same tasks, personnel, and work hours across the study period, and also had a regular work schedule, including an alternating period of 5 consecutive night shifts and day shifts. This likely led to a lower fatigue score as compared with that observed in nurses and care workers.

2. Diurnal fatigue scores and fluctuations in fatigue

1) Before work

For fatigue assessed before work (after coming back from a day off), the total score and the measuring subscale were higher for daytime work compared with those for nighttime work in every case. The reason for this may be related to the effect of the differences in break time after work. Both nighttime work and daytime work include 5 days of work and 2 days off. The work time per person per day is 8 hours, amounting to 40 hours per week. The interval between work periods can be as high as 15 hours, exceeding the 11 hours specified in the EU Labor Hours Directive[23]. However, a focus on the work start and end times, as shown in Fig. 1, reveals a major difference in the number of break hours between shifting from nighttime to daytime work compared with that for shifting from daytime to nighttime work. Similarly, in previous studies[24], lengthening the interval for work shift changes was shown to improve fatigue, and the difference in break length after work appeared to have an effect on the fatigue score before returning to work after time off.

2) After work

Kogi[25] reported that individuals engaged in consecutive night shifts repeatedly work against the diurnal rhythm of their biological clock (through their sleep schedule), and hence, do not recover from fatigue; instead, the fatigue accumulates and becomes chronic. A survey of individuals who worked 5 consecutive night shifts to clean the Shinkansen (the bullet train)[10] indicated the occurrence of peak fatigue on the fifth day. However, in the current study, this kind of simple increase in the total score or the measuring subscale was not observed.

Harano et al.[15] reported that the accumulation of fatigue is affected by the manner in which a person spends his or her night shift. A survey of fatigue among care workers showed that night shift workers avoided unnecessary activity during the daytime on days they were to work the night shift; in fact, after a night shift, a person's lifestyle is centered on rest, which suggests that they take measures to avoid the accumulation of fatigue[15]. Although the mean sleep duration in the current study population was shorter than that for Japanese men in the general population (469 minutes)[26], the amount of sleep was similar between the night shift and day shift workers. Moreover, except for 1 subject who behaved in a manner that affected fatigue recovery, the lifestyles of the subjects were centered on rest. This could have led to the noted uneven fluctuations in fatigue over the study period.

In the measurement subscale, there was hardly any difference in Groups II to V, but a significant difference was observed in Group I drowsiness. In addition, the fatigue fluctuations in nighttime and daytime work did not show a mutual interaction in the total score or the measuring subscale, and virtually showed the same trends. Therefore, the characteristics of the work shift involving switching from day to night or vice versa, which is different from the irregular switching experienced by nurses and similar professions, appear to have an effect on fatigue. The biological clock has a weekly rhythm of 7 days[27], which has developed due to cultural and social lifestyle conventions[28]. As a result, the target groups in this research formed their own independent rhythms during the week, which may have affected fatigue. However, even though there was a significant difference in Group I drowsiness, and there was no significant difference after Day 3; it is also true that the night shift scores were high on all days. During the night, the body has a low activity level owing to its circadian rhythm. In addition to the fact that working at night can be lead to fatigue[25], nighttime workers are awake during their sleep time and free time, before returning to work. This means that nighttime workers work after long periods of wakefulness, which can hasten fatigue[29]. Even for persons used to the regimen, similar fatigue scores are observed. Based on the above facts, it was reaffirmed that the 5-day consecutive night shift regime was never a desirable work regime.

While the peak total fatigue score was seen on Day 3 for both nighttime and daytime work, fluctuations began to appear in the measuring subscale from halfway through the week into the latter half. Thus, determining the fatigue peak was difficult. Although several companies have recommended that Wednesdays serve as a no-overtime day, literature explaining the reasoning underlying this practice is scarce[30]. Based on our findings, we support the need for a break in the middle of the week; nevertheless, future studies are required regarding this finding.

Characteristics of subjects with chronic fatigue

We compared the individual attributes between the high, and low chronic fatigue groups, and found that the mean age was higher, work duration was longer, and the duration of night shift work was greater in the high chronic fatigue group; however, the differences were not significant. It is possible that these subjects are sufficiently familiar with their work and are not aware of their fatigue. In addition, the mean sleep duration was short for both night and day shift workers. A survey that targeted publishing industry workers indicated that individuals complaining of chronic fatigue had worked long hours and had little rest and a short sleep duration; moreover, the number of complaints of subjective symptoms were significantly greater in that population[31]. The sleep duration in the present study population was shorter than that of the mean value for Japanese men (469 minutes)[26], and, because the sleep duration of the high chronic fatigue group was particularly short, we believe that the subjects did not sufficiently recover from their fatigue, which effectively accumulated as a result of the lack of sleep.

In addition, we assessed the mean diurnal fatigue score in the high chronic fatigue group. We found that this score was lower in the high chronic fatigue group compared with the low chronic fatigue group for night and day shifts. Moreover, the subjective symptoms caused by chronic fatigue are reportedly more intense than those caused by diurnal fatigue[16]. Thus, we expected that the diurnal fatigue scores of the high chronic fatigue group would be high; however, the results were not as expected. The evaluation of fatigue may not have accounted for the type of fatigue where the individuals who are fatigued are not actually aware of it[16]. In those cases, the state of fatigue becomes normal, and one then loses awareness of their fatigue level, leading to chronic fatigue. Considering this information and the individual attributes, it can be stated that the high chronic fatigue group became desensitized to diurnal fatigue because of familiarity with their work. Significant differences in the night shift score in the low chronic fatigue group and small differences in the diurnal fatigue score between the night and day shifts compared with those in the low chronic fatigue group suggest that these subjects were particularly desensitized to their fatigue because of working the night shift.

Based on these results, determining the workers who require reminder dates (an objective of the present study) requires an understanding of both diurnal and chronic fatigue. Further studies are needed to investigate the factors affecting chronic fatigue.

Limitations of the present study and future prospects

In the present study, we only examined 38 subjects; hence, care must be taken when generalizing the present results. In the future, the number of survey subjects and the surveyed job categories should be increased for a more thorough investigation.

Conclusions

In the present study, we examined diurnal and chronic fatigue associated with night and day shifts in 38 male workers from the manufacturing industry, who were engaged in 5 consecutive night shifts. The main findings of the study are as follows:

1. After day 3, the night shift fatigue scores appeared consistently higher albeit the differences were not statistically significant.

2. Fluctuations in fatigue between night shift and day work remained almost identical.

3. Persons exhibiting high levels of chronic fatigue had low diurnal fatigue scores.

4. The subjective symptoms of fatigue before work on the first day of work after a holiday were higher for daytime work compared with those for nighttime work.

It is thus essential to assess the workers' conditions of both diurnal and chronic fatigue over consecutive night shifts in order to lay down criteria for practical health guidance, healthy working environment and industrial accident preventives.

Acknowledgements

We would like to thank all the individuals involved in this research for their co-operation and help. This research was made possible with the financial support of the 2013 Grant-in-Aid for Scientific Research for Young Scientists (B) (Issue Number 25862272).

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

1) Statistic Bureau, Ministry of Internal Affairs and Communications: 2007 Worker health situation investigation. e-Stat. 2009-3-25. http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001020613&cycode=0 (accessed 2016-01-05).
2) Takahashi M: Koutaiseikinmu to Suimin, Suiminsyougai no Kisochishiki. Ishii M, Imamura S, Shima S, Takata T, editors. Tokyo, Personnel Research Institute, 2008, pp 66—92.
3) Knauth P, Rutenfranz J: Development of criteria for the design of shiftwork systems. Journal of Human Ergology 11 (suppl): 337—367, 1982.
4) National Institute for Occupational Safety and Health: Plain language About Shiftwork. Centers for Disease Control and Prevention. 1997-7. http://www.cdc.gov/niosh/docs/97-145/pdfs/97-145.pdf (accessed 2016-01-05).
5) International Labor Organization: R178 - Night Work Recommendation, 1990 (No. 178). 1990-6-26. http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:R178 (accessed 2016-01-05).
6) Japan Society for Occupational Health Koutaikinmu Iinkai: Yakin・Koutaiseikinmu ni Kansuru Ikensyo. Sangyo Igaku 20: 308—344, 1978.
7) Togo F: Physical Activity and Mental and Physical Health in Rotating Shift Workers. The Twenty-four Research Aid Report 24: 90—101, 2009.
8) Sasaki T, Suzuki K, Kubo T, et al: Effects on Sleep Architecture of Naps Taken on the Simulated Two-consecutive Night Shifts. J Science of Labour 81 (4): 161—168, 2005.
9) Kubo T, Tachi N, Takeyama H, et al: Characteristic Patterns of Fatigue Feelings on Four Simulated Consecutive Night Shifts by "Jikaku-sho Shirabe". Sangyo Eiseigaku Zasshi 50: 133—144, 2008.
10) Ueno M, Nakagiri S, Taniguchi T, et al: Effect of consecutive night-shift work on health conditions among car-cleaners of super-express trains. Jpn J Ind Health 26: 483—491, 1984.
11) Folkard S, Tucker P: Shift work, safety and productivity. Occupational Medicine 53 (2): 95—101, 2003.
12) Sasaki T: Manseihirou no Haikei ni Arumono. Digest of Science of Labour 57 (5): 5—8, 2002.
13) Urita K, Yamakoshi M, Kawahara N, et al: Hensoku 2koutai Kinmugo ni okeru Yakingo no Hirou Kaihuku. Medical Journal of Takayama Red Cross Hospital 36: 65—68, 2012.
14) Mikami Y, Iseki T: Koureisya Nyusyo Shisetsu de Hataraku Kaigohukushi-shi no Hirou no Kentou. The Bulletin of Niimi Col-

lege 31: 117—123, 2010.
15) Harano K, Taniguchi T, Kobayashi H: Fatigue in Night-Duty Professional Caregivers Working at a Public Long-Term Care Facility for the Elderly. Kawasaki Medical Welfare Journal 21 (2): 208—217, 2012.
16) Statistic Bureau, Ministry of Internal Affairs and Communications: Labour force survey (basic count) October in 2015 Breaking news. 2015. http://www.stat.go.jp/data/roudou/rireki/tsuki/pdf/201510.pdf (accessed 2016-01-05).
17) Japan Industrial Safety & Health Association Kenkoukakuho Suishinbu: Heisei 14nendo Roudousha no Hirouchikusekido Jikoshindan Check List Sakusei Iinkai Houkokusyo: 2003. 3.
18) Japan Society for Occupational Health Working Group for Occupational Fatigue: Jikaku-sho Shirabe. 2002. http://square.umin.ac.jp/of/service.html (accessed 2016-01-05).
19) Ministry of Health, Labour and Welfare: Roudousha no Hirouchikusekido Check List. 2004. http://www.mhlw.go.jp/topics/2004/06/tp0630-1.html (accessed 2016-01-05).
20) Japanese Nursing Association: Kango-syoku no Yakin・Koutaisei-kinmu ni Kansuru guide line. Tokyo, Japanese Nursing Association, 2013, pp 2—3.
21) Sasaki T: Rule ga Wakareba Kawaru Kango-shi no Koutaikinmu. Tokyo, Kango-no-kagaku-sya, 2011, pp 32.
22) Ministry of Health, Labour and Welfare: Heisei 26 nendo Eiseigyousei houkokurei (Syugyouiryoukankeisya) no gaikyou. 2015. http://www.mhlw.go.jp/toukei/saikin/hw/eisei/14/dl/gaikyo.pdf (accessed 2016-11-03).
23) European Parliament. Council of the European Union: 2003. Directive 2003/88/EC of the European Parliament and of the Council of 4 November 2003 concerning certain aspects of the organisation of working time. 2003. http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32003L0088 (accessed 2016-11-03).
24) Morikuni I:【Sangyousyakai to suimin】Roudougenba deno suimin・seitairizumucyousetu. Suiminiryou 3: 390—395, 2009.
25) Kogi K: Gendaijin to Hirou Zouhoban. Tokyo, Kinokuniya, 1994, pp 124—130.
26) Statistic Bureau, Ministry of Internal Affairs and Communications: 2011 Basic survey of social living practices. e-Stat. 2012. http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001041121&cycode=0 (accessed 2016-11-03).
27) Shimazu T, Kato H, Masuyama E: Kenkou no Kagaku. Kyoto, Kagakudoujin, 2001, pp 61—72.
28) Ibuka N: Koudou no Jikan Seibutsu-gaku. Tokyo, Asakura Publishing, 1990, pp 133—143.
29) Tepas DI, Duchon JC, Gersten AH: Shiftwork and the older worker. Exp Aging Res 19 (4): 295—320, 1993.
30) Nishida M: Suiyoubi ni “Tsukareta” to Tubuyakanai 50 no Houhou. Tokyo, Asahi Shimbun Publications, 2012, pp 74—77.
31) Maehara N, Sasaki T, Akahori M: The Frequency of Occurrence and Characteristics of Chronic Fatigue Studied by Questionnaire Surveys. J Science of Labour 82 (1): 1—13, 2006.

Reprint request:
Ayako Ogata
Department of Community Health Nursing, Oita University of Nursing and Health Sciences, 2944-9, Megusuno, Oita-City, 870-1201, Japan.

別刷請求先 〒870−1201 大分県大分市廻栖野 2944—9
大分県立看護科学大学看護学部広域看護学講座
緒方 文子

5日間連続夜勤における疲労の発現と変動

緒方　文子[1)2)]，鳩野　洋子[3)]
[1)]九州大学大学院医学系学府保健学専攻博士後期課程
[2)]大分県立看護科学大学看護学部広域看護学講座
[3)]九州大学大学院医学研究院保健学部門

―キーワード―
連続夜勤，疲労，自覚症状

目的：5日間連続夜勤を5日間連続日勤と週替わりで行う者に対して，夜勤時と日勤時の日周性疲労及び慢性疲労の調査を行い，日周性疲労の変動及び慢性疲労に影響する要因を明らかにすることを目的とした．

方法：製造業に従事する男性94名に対し，自記式質問紙調査を実施した．内容は基本的属性及び，日周性疲労の評価のための「自覚症しらべ」，慢性疲労の評価のための「労働者の疲労蓄積度チェックリスト」である．属性及び慢性疲労は，調査初日の勤務前，日周性疲労は休み明けの勤務初日の勤務前と勤務終了後に毎日調査を行った．

結果：5日間連続夜勤を行った38名を分析対象とし，平均年齢27.8歳，勤務期間は63.1カ月であった．夜勤と日勤の日周性疲労を比較すると，休み明けの勤務前は日勤の得点が高く，勤務後においては全ての日で夜勤の得点が高かった．特にねむけ感では，全ての日において有意差が見られた．変動は，夜勤と日勤でほぼ同様に推移した．慢性疲労が高い者は22名で，日周性疲労の得点が低かった．

考察：夜勤と日勤における疲労の変動は，規則的なシフトの影響により独自の週内リズムが形成され，ほぼ同様に推移したと推測される．しかし，今回の結果から，5日間連続夜勤は決して望ましい勤務体制ではないことが再認識された．慢性疲労が高い者は仕事への慣れから日々の疲労に対して無自覚であり，特に夜勤における疲労に対して無自覚になっていると考えられる．

利益相反：利益相反基準に該当無し

（日職災医誌，65：190―200，2017）