In Japan, there is a set of experiences called *kanashibari*, which is symptomatically identical to sleep paralysis with or without hypnagogic hallucinations. In a former study (Fukuda et al., 1987a), the author and co-workers have investigated this phenomenon by a questionnaire method and have found that among the normal population the phenomenon is apparently more common than has been usually appreciated. The author conducted this study to confirm the coincidence between *kanashibari* and sleep paralysis polygraphically, and then to investigate the characteristics of sleep onset REM periods (SOREMPs) with the *kanashibari* phenomenon. The two subjects with frequent experiences of *kanashibari* and the other two subjects without the experience slept under an altered sleep schedule. The schedule, which consisted of reversal of usual sleep-wakefulness cycle and sleep interruption. One of the subjects reported that she had been about to have a *kanashibari* attack during the experiment. During the REM sleep, when the subject was probably about to experience *kanashibari*, abundant alpha EEG and an elevated heart rate were observed. The author suggests the relations between a higher consciousness level in *kanashibari* and the abundant alpha EEG, and between emotional components of the phenomenon and the increased heart rate.

Key words: *kanashibari* phenomenon, sleep paralysis, normal human, polygram.

---

1) I wish to thank Misses Hiroe Suzuki, Junko Tanaka and Kumi Yoshida for their technical assistance in the execution of this research. I also gratefully acknowledge the invaluable assistance of Dr. Takahiko Yagi (Shiraume Gakuen Junior College). This study was supported in part by a Grant-in-Aid for Encouragement of Young Scientists (No. 62790031) from The Ministry of Education, Science and Culture of Japan. Part of this article was presented to the 5th congress of The Japanese Society for Physiological Psychology and Psychophysiology in Hiroshima, June, 1987.

Received April 24, 1989; accepted October 11, 1989.

福田一彦
Sleep paralysis has usually been described in terms of its association with narcolepsy. In fact, it is considered to be one of the components of narcolepsy tetrad (i.e., sleep attack, cataplexy, sleep paralysis, and hypnagogic hallucinations). Although sleep paralysis is frequently associated with other narcoleptic syndromes, it also occurs independently in otherwise healthy individuals without sleep attack or cataplexy. In "Diagnostic Classification of Sleep and Arousal Disorders" by the Association of Sleep Disorders Centers (ASDC, 1979), this isolated form of sleep paralysis is classified as "familial sleep paralysis." This work quotes from Goode (1962), in which he found that 4.7% of normal respondents had experienced isolated sleep paralysis, and suggests that this figure is overestimated. There are some case reports of isolated sleep paralysis (Mitchell, 1876; Roth et al., 1968; Schneck, 1948, 1957, 1960, 1969; Snyder, 1983; Van der Heide et al., 1945); however, there is little epidemiological research on this phenomenon. Everette (1963) found that 15.4% of the 52 respondents had experienced isolated sleep paralysis. Recently, Penn et al. (1981) found it in 16.3% of 80 college students.

On the other hand, in Japan, there is a set of psychological and physical experiences involving paralysis, usually with terror or anxiety, and with or without hallucinations, during the transitional period between sleep and wakefulness. These experiences have traditionally been interpreted broadly in the country as a phenomenon called kanashibari. This phenomenon is symptomatically identical to sleep paralysis with or without hypnagogic hallucinations. In a former study (Fukuda et al., 1987a), the author and co-workers investigated this phenomenon by means of a questionnaire and found that, among the normal population, the phenomenon is apparently more common (about 40% of normal respondents) than is usually appreciated.

Much research (Hishikawa et al., 1965; Suzuki, 1966; Koida et al., 1971; Hishikawa et al., 1978) has suggested that sleep paralysis and hypnagogic hallucinations can be interpreted polygraphically as REM sleep occurring unusually earlier or at the onset of patients' sleep (Sleep onset REM periods: SOREMPs). The kanashibari phenomenon is symptomatically identical to sleep paralysis; however, this identity has not been confirmed physiologically. If these two phenomena are truly identical, the kanashibari phenomenon will occur in relation to SOREMPs. Sleep paralysis does not occur in every SOREM. Hishikawa et al. (1978) suggested that the patients experience sleep paralysis and/or hypnagogic hallucinations during SOREMPs occurring directly from wakefulness or less than 2 min from sleep onset. They also pointed out that these SOREMPs have more abundant alpha waves than the SOREMPs without sleep paralysis.

One of the purposes of this paper is to confirm the identity between kanashibari phenomenon and sleep paralysis polygraphically. The other one is to clarify the differences between SOREMPs with sleep paralysis and those without sleep paralysis, if differences really exist.

SUBJECTS AND METHODS

A questionnaire relating to kanashibari experience was distributed to female college students. We selected 4 subjects on the basis of their responses to the questionnaire. Two of the subjects experience kanashibari phenomenon frequently, i.e., several times per month, while the other two subjects have no experience of the phenomenon. No subjects experienced any other narcoleptic symptoms (i.e., sleep attack and cataplexy).

SOREMPs are known to appear in the sleep of normal subjects under altered sleep
schedules. Weitzman et al. (1970) reported SOREMPs in the sleep of normal young adults who had been subjected to an acute reversal of the sleep and wakefulness cycle. Following the ultradian sleep and wakefulness schedule, normal subjects frequently displayed SOREMPs (Weitzman et al., 1974, Carskadon & Dement, 1975). Endo et al. (1981) reported that SOREMPs appeared more frequently during morning naps than during afternoon or evening naps. SOREMPs frequently appear after only one interruption of nocturnal sleep (Fukuda et al., 1987b; Miyasita et al., 1989). The subjects were required to sleep under an altered sleep schedule, which contained experimental protocols of reversal of sleep and wakefulness cycles and of sleep interruption. The subjects stayed awake throughout the night at their home. To keep a subject awake, at least one of the research staff accompanied the subject throughout the night. The next morning, the subjects reported to the laboratory, and they took four 30-min bedrests from 1000 to 1500 (nap 1, 2, 3, and 4). These bedrests were separated by one hour of wakefulness (see Fig. 1). EEGs were recorded from F3, F4, C3, C4, O1, and O2. EOG electrodes were attached at the outer canthi. Chin EMG, left and right forearm EMG, ECG, and respiration were recorded. After every nap, Kwansei Gakuin Sleepiness Scale (KSS) (Ishihara et al., 1982), and Mood Adjective Check List (MACL) (Nowlis, 1965), and dream recall were performed.

Polygraphic records were analyzed visually and scored each 30s epoch according to the standard criteria for sleep staging (Rechtschaffen & Kales, 1968). Heart rate and respiration rate were counted for each 30s epoch. REM density was counted for each 30s epoch during REM sleep.

RESULTS AND DISCUSSION

Only in 3 of 16 naps of the subjects SOREMP with a latency of less than 25 min (Miyasita et al., 1989) occurred. Subject 86101 with kanashibari experience exhibited 2 SOREMPs in nap 3 and nap 4, while Subject 86100 without kanashibari experience exhibited a SOREMP in nap 3. The other subjects exhibited no SOREMP (Fig. 1).

Although, no kanashibari experience was reported, Subject 86101 reported on the dream recall after nap 4 that she had been about to have a kanashibari attack during the nap just preceding. According to her report, she was dreaming a very vivid dream, when suddenly she heard a clicking sound, and then her consciousness level became very high. She felt she was about to have a kanashibari attack, but she went back to deeper sleep again. Kanashibari sufferers often state that they can previously tell whether kanashibari attack will occur or not, even before going to bed. They unanimously state that some physical signs precede the attack, although, they cannot define the signs. The only state that physical exhaustion or sleep loss are likely to precede the attack (Fukuda et al., 1987a).

During the latter half of the REM period in nap 4, the subject exhibited abundant alpha EEG compared with that during the other parts of the REM period of the same subject (Fig. 2). Hishikawa et al. (1978) suggested that in narcoleptic patients an amount of the alpha EEG was significantly larger during SOREMP accompanied by sleep paralysis with or without hypnagogic hallucinations than during the other SOREMPs. They also investigated REM density, stage REM latency from sleep onset, and duration of stage REM. Among these parameters, only the stage REM latency showed a significant difference between SOREMPs with sleep paralysis and/or hypnagogic hallucinations and SOREMPs without them. The mean
Fig. 1 Sleep diagrams of the subjects under an altered sleep schedule. The subjects took four 30 min bedrests from 1000 to 1500 (nap 1, 2, 3, and 4). These bedrests were separated by one hour of wakefulness. The black areas in the horizontal lines above the sleep diagrams mean the bedrests, during which period the light was turned off. K⁺ means a subject with kanashibari experience and K⁻ means one without the experience.

Fig. 2 Polygraphic tracings of SOREMPs with (right) or without (left) the abundant alpha EEG.
latency of SOREMPs accompanied by sleep paralysis with or without hypnagogic hallucinations was significantly shorter than that in the other SOREMPs (Hishikawa et al., 1978).

Hishikawa et al. (1978) did not investigate autonomic variables. Autonomic variables (e.g., heart rate, respiration rate, and skin potential etc.) are well-known to show phasic changes in stage REM. The author investigated heart rate and respiration rate in addition to REM density in the present study. Fig. 3 shows the variation of these parameters during nap 3 and 4 of Subject 86101. Table 1 summarizes the mean values of each phasic parameter during the REM period in naps 3 and 4. None of those three parameters showed a significant difference between during REM period in nap 3 and during that in the nap 4. Table 2 shows those mean values during the period with abundant alpha waves and those during the period without alpha waves during the REM period in nap 4. Her heart rate showed a significant increase during the period with the abundant alpha EEG compared with the period without it (Table 2, \( p < 0.05, t = 4.986, \text{df} = 18 \)). The abundant alpha EEG during REM sleep is considered to be associated with lucid dreaming\(^2\) (Ogilvie et al., 1982a; Ogilvie et al., 1982b; Tyson et al., 1984). So, the abundance of alpha EEG probably means that the subject’s consciousness level was rather high compared with the other REM sleep with low alpha EEG. The increased heart rate may be associated with the patient’s higher consciousness level. However, in conclusion, the author ventures to offer another interpretation of this heart rate change, namely, that the above-mentioned high rate of heart beats may be concerned with emotional components (terror or anxiety) emerging in kanashibari attack.

Table 1. REM density, heart rate, and respiration rate per 30s during SOREMPs of subject 86101. None of these three parameters showed a significant difference between during REM period in nap 3 and during that in nap 4.

<table>
<thead>
<tr>
<th>REM density</th>
<th>Heart Rate</th>
<th>Respiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAP 3</td>
<td>3.0(2.65)</td>
<td>32.3(1.62)</td>
</tr>
<tr>
<td>NAP 4</td>
<td>5.6(6.26)</td>
<td>33.2(3.02)</td>
</tr>
</tbody>
</table>

SDs in parentheses

Table 2. REM density, heart rate, and respiration rate per 30s during SOREMPs in nap 4 of subject 86101. Her heart rate showed a significant increase during the period with the abundant alpha EEG (ALPHA) compared with the period without it (Non-ALPHA).

<table>
<thead>
<tr>
<th>REM density</th>
<th>Heart Rate</th>
<th>Respiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHA</td>
<td>5.3(6.69)</td>
<td>36.3(2.91)*</td>
</tr>
<tr>
<td>Non-ALPHA</td>
<td>5.8(6.00)</td>
<td>31.5(1.15)</td>
</tr>
</tbody>
</table>

*\( p < 0.05, \) SDs in parentheses.

\(^2\) dreams in which the dreamer is aware he is dreaming and may be able to control the dream content (Ogilvie, 1982a).
REFERENCES
Association of Sleep Disorders Centers. Diagnostic Classification of Sleep and Arousal Disorders, First Edition, prepared by the Sleep Disorders Classification Committee, H. P. Roffwarg, Chairman, 1979 Sleep 2: 1–137.
Snyder, S. 1983 Isolated sleep paralysis after rapid time zone change (‘jet lag’) syndrome.


