A Survey of Bedroom and Bed Climate of the Elderly in a Nursing Home

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Abstract. Bedroom and bed climate of the elderly in a nursing home were surveyed. Twenty-two elderly subjects were divided into four groups depending on their Activity of Daily Living (ADL) and gender. The four groups were: male and female subjects with almost no problems in daily life and an ADL score higher than 5 [H males, H females] and male and female subjects who normally stayed in bed all day with an ADL score lower than 2 [L males, L females]. The temperature and humidity of the bedroom and bed climate were measured continuously for 24 hours. Bedding and clothing condition, subjective sensational vote and subjective sleep evaluation were surveyed before and after sleep for five days continuously. In the daytime, bedroom and bed climate temperature was significantly lower in H females than in the other groups. At night, no significant effect of gender and ADL was observed in bed climate, which was maintained at 33~35°C, RH50~60% in all the groups. Bedding under the body increased significantly in L males and L females compared with H males and H females. The number of underwear increased significantly in H females. Subjective sleep evaluation was significantly better in H females than the other groups. These results suggest that ADL and gender based differences should be taken into account with regard to the care of the elderly in a nursing home.

Keywords: elderly, nursing home, bed climate, ADL, sleep

Introduction

Thermal environment is one of the important factors that affects sleep. Many previous studies concerning the effects of thermal environment on sleep (for example, Miyazawa, 1974) have focused on bed climate as it directly affects thermal comfort during sleep (Candas, 1979). According to a previous study, the comfort bed climate zone is around 32-34°C, RH 45-65% (Miyazawa, 1974). This value is based on healthy young females and it is not yet known if this value applies to the elderly. The bed climate has at least two important aspects for the elderly: comfort and the prevention of decubitus. The humidity level is important in the prevention of decubitus as wetness in bedding doubles the friction force as compared to that of dry bedding (Biesecker, 1995). Comfortable bed climate is essential as we generally stay in bed for one-third of the day. Bedridden elderly remain in bed for almost 24 hours. However, most previous studies have surveyed environmental climate under which the healthy elderly live at home (Miyazawa, 1995; Igarashi, 1995; Okamoto, 1993a) and very few studies have surveyed the bed climate (Nakayama, 1994) or the living environment of the elderly in a nursing home (Adachi, 1994).

This study focused on the Activity of Daily Living (ADL) and gender as bed climate is affected by ADL (Adachi, 1994) and subjective sleep evaluation is affected by gender (Spiegel, 1981). The objective of this study was to examine the effects of ADL and gender on bedroom and bed climate of the elderly in a nursing home.

Method

Subjects
A survey was conducted in August, 1995. The subjects were 22 elderly volunteers in a nursing home that was located in the centre of Tokyo. They were informed about the survey in advance and signed consent forms. The physical characteristics of the subjects are shown in Table 1. None of the subjects had any evidence of psychiatric disease. The subjects were divided into four groups depending on their ADL and gender. The ADL score was calculated according to Katz’s criteria (1970). One point was scored when the subject did not have difficulty in executing the activities in Katz’s criteria and the sum of the six criteria was used as the ADL score. The four groups were: subjects who had no problem in executing most of the Katz’s criteria with an ADL score higher than 5 [H males, H females] and subjects who
normally stayed in bed all day with an ADL score lower than 2 [L males, L females].

Features of the nursing home and schedule of the day

The bedrooms in this nursing home were shared by two or four persons. All bedrooms had a window in the south direction and the weather during the survey was sunny. The subjects in each group were selected from 3 different bedrooms. A bed, a mattress, a futon and a blanket were supplied by the nursing home, however the subjects were free to use other bedding and their own clothing. The bedroom could be partitioned individually using a curtain. Air temperature and humidity of each bedroom was separately controlled by the air conditioner. Although this nursing home recommended a 30°C “dry” setting for the air conditioner in summer, the elderly and the caretaker were allowed to change the setting as they wish according to their thermal sensations.

The elderly residents were woken up at about 6:00 a.m. in the morning. They had their meals at 7:00 a.m., 12:00 noon and 5:00 p.m. The afternoon refreshments were served at 3:00 p.m. Lights were turned off at 9:00 p.m. During the day, H males and H females generally stayed in their bedroom. They moved to the meeting room for meals and afternoon refreshments and were able to participate in club activities, such as flower arrangement, calligraphy and singing classes which were organised at least three times per week from 3:00 p.m. On the other hand, L males and L females spent their day almost entirely in bed. They were taken to a meeting room by using a wheelchair for the meal, afternoon refreshments and certain club activities, such as singing. The body positions and diapers were changed every two hours during the day and at night.

Measurements

1. Bedroom and bed climate

The bedroom and bed climate of the each subject was measured for 24 hours starting at 7:00 a.m. using a thermometer and a hydrometer (Data stocker, TRH-DM3, Shinei) at 1-min. intervals. The sensor for measuring the bed temperature was placed on the wall near each subject’s bed. The measuring areas of the bed climate were the back and foot area beneath the bed sheet.

2. Survey of bedding condition and subjective sensation

The survey of bedding and clothing condition, subjective sensational vote and subjective sleep evaluation were surveyed continuously for five days. The number and types of bedding and clothing were checked before and after sleep. At the same time, comfort (+3: Very comfortable to -3: Very uncomfortable), thermal (+3: Very hot to -3: Very cold) and humidity (+3: Very dry to -3: Very humid) sensational votes were obtained. The bed temperature and humidity at the time that the sensational votes were obtained were measured by a thermometer and a hydrometer (Huger) that had been placed on the wall of each bedroom. Subjective sleep evaluation was asked by using a scale from -3 to +3 on the following four factors: sleep depth, sleep onset, refreshed state in the morning and satisfaction of sleep time. Subjects were asked to mark their evaluation on the scale. Zero indicated the medium score.

Data analysis

In order to analyse the statistical significance, three-way ANOVA for repeated measures was used for the bedroom and bed climate. The data was calculated separately in the day (7:00-20:00) and at night (21:00-6:00). The factors were ADL (H and L), gender and time. The two-way ANOVA was used for the survey of bed condition and subjective sensation. The factors were ADL (H and L) and gender. Spearman’s rank correlation was also used for analysing the relation between bedroom temperature and thermal sensation. The level of significance was assumed to be P<0.05.

Results

Bedroom and bed climate

Table 2 shows the results of three-way ANOVA for repeated measures and Fig. 1 shows the changes in temperature of the bedroom and bed climate. Regarding bedroom temperature, an effect of gender and interaction between gender and ADL was observed. Temperature for the H males was highest at around 27°C, while that of H females was the lowest and stable at 25°C. At night, no significant effect of gender or ADL was observed. No significant effect of ADL or gender was observed on the
**Table 2** F-ratios and associated probability levels from analysis of variance for repeated measures of bedroom and bed climate

<table>
<thead>
<tr>
<th>Day</th>
<th>Gender</th>
<th>ADL</th>
<th>Time</th>
<th>A × G</th>
<th>T × G</th>
<th>T × A</th>
<th>T × A × G</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bed Room</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(°C)</td>
<td>8.18</td>
<td>1.56</td>
<td>2.45</td>
<td>4.51</td>
<td>2.48</td>
<td>2.70</td>
<td>2.86</td>
</tr>
<tr>
<td>(RH%)</td>
<td>3.77</td>
<td>2.98</td>
<td>5.62</td>
<td>2.76</td>
<td>1.00</td>
<td>1.79</td>
<td>2.12</td>
</tr>
<tr>
<td><strong>Bed Climate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(°C)</td>
<td>2.25</td>
<td>11.82</td>
<td>5.36</td>
<td>7.73</td>
<td>1.35</td>
<td>2.22</td>
<td>1.77</td>
</tr>
<tr>
<td>(Waist) (RH%)</td>
<td>0.19</td>
<td>1.06</td>
<td>6.50</td>
<td>0.82</td>
<td>1.73</td>
<td>2.01</td>
<td>0.64</td>
</tr>
<tr>
<td>(Foot) (RH%)</td>
<td>0.16</td>
<td>21.33</td>
<td>4.12</td>
<td>22.55</td>
<td>3.52</td>
<td>2.54</td>
<td>1.87</td>
</tr>
<tr>
<td>df</td>
<td>1/16</td>
<td>1/16</td>
<td>13/208</td>
<td>1/16</td>
<td>13/208</td>
<td>13/208</td>
<td>13/208</td>
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<tr>
<td><strong>Night</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Bed Room</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(°C)</td>
<td>1.64</td>
<td>0.01</td>
<td>1.60</td>
<td>11.7</td>
<td>3.97</td>
<td>2.44</td>
<td>7.42</td>
</tr>
<tr>
<td>(RH%)</td>
<td>0.34</td>
<td>1.30</td>
<td>10.95</td>
<td>0.46</td>
<td>1.75</td>
<td>1.37</td>
<td>1.23</td>
</tr>
<tr>
<td><strong>Bed Climate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(°C)</td>
<td>1.02</td>
<td>0.04</td>
<td>24.76</td>
<td>0.02</td>
<td>0.55</td>
<td>9.32</td>
<td>0.74</td>
</tr>
<tr>
<td>(Waist) (RH%)</td>
<td>0.19</td>
<td>0.04</td>
<td>1.57</td>
<td>0.52</td>
<td>0.46</td>
<td>1.29</td>
<td>0.99</td>
</tr>
<tr>
<td>(Foot) (RH%)</td>
<td>0.55</td>
<td>0.3</td>
<td>3.33</td>
<td>2.24</td>
<td>1.14</td>
<td>1.12</td>
<td>1.33</td>
</tr>
<tr>
<td>df</td>
<td>1/16</td>
<td>0.74</td>
<td>1.29</td>
<td>0.99</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
</tbody>
</table>

The asterisk indicates the level of significance (*P<0.05, **P<0.01, ***P<0.001). A × G, T × G, T × A and T × A × G indicates interaction among ADL (A), gender (G) and time (T). df: degree of freedom.

![Room Temperature](image1)
![Bed Climate Waist Area](image2)
![Bed Climate Foot Area](image3)

**Fig. 1** Changes of bedroom and bed climate. Average of each group.
relative humidity of the bedroom, which was maintained at 45–70% in all groups.

As for the bed climate of the waist and foot area during the day, a significant effect of ADL and interaction between gender and ADL were observed on temperature. The H females showed the lowest temperature and the other groups maintained a higher temperature with a temperature decrease during meals and afternoon refreshments. No significant effect was observed in relative humidity. At night, no significant effects of ADL or gender were observed and the temperature and relative humidity were maintained at 33 to 35°C, and 45–60% respectively in all groups. The H females showed a clear difference in waist and foot area temperatures between day and night, while the difference was not clear in the other groups.

Survey of bedding condition and subjective sensation
Bedding and clothing condition did not show any change during the five days. Fig. 2 shows the number of bedding. Although the number of bedding over the body did not show any significant difference, bedding under the body significantly increased in L males and L females (Fig. 2). The number of outerwear did not show any significant difference while the number of underwear increased significantly in H females. Correlation between thermal sensation and the bedroom climate before and after sleep was calculated since the bedroom temperature showed a significant effect of gender. A significant correlation was observed in H and L females, but a correlation was not found in H and L males (Fig. 3). H and L females voted slightly hot at 26°C. After sleep, no significant correlation was observed. As subjective sleep evaluation did not change during the five days, the five subjective sleep evaluations of each subject were averaged. The subjective sleep evaluation was relatively good in all groups not showing minus score. Sleep onset was significantly higher, and satisfaction of sleep time and depth tended to be higher in H females (Table 3).

Discussion
The optimal temperature recommended for the living
Table 3 Mean value of subjective sleep evaluation. F-ratios and associated probability levels from two way analysis of variance

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep Onset*</td>
<td>1.49 (0.59)</td>
<td>2.36 (0.62)</td>
<td>1.47 (0.64)</td>
<td>0.66 (1.04)</td>
</tr>
<tr>
<td>Refreshed State</td>
<td>1.60 (0.68)</td>
<td>1.73 (1.18)</td>
<td>1.81 (0.75)</td>
<td>0.85 (1.24)</td>
</tr>
<tr>
<td>Sleep Time</td>
<td>1.33 (0.53)</td>
<td>2.50 (0.40)</td>
<td>0.75 (1.00)</td>
<td>0.87 (1.05)</td>
</tr>
<tr>
<td>Depth</td>
<td>1.50 (0.46)</td>
<td>2.53 (0.49)</td>
<td>1.19 (0.58)</td>
<td>0.96 (1.02)</td>
</tr>
</tbody>
</table>

*F-ratios were Gender, 0.10 (N.S.); ADL, 3.63 (N.S.); Interaction, 4.44 (P<0.05).

environment of the elderly is 25~29°C (Iwashige, 1995) and sleep disturbance increases when the bedroom temperature increases higher than 28°C (Imai, 1986). Although all groups were in this range, H females showed a significantly lower and stable bedroom temperature than the other groups. One reason for this difference might have been the increased number of underwear worn by H females and their more active behaviour compared to the other groups during the daytime. Another reason may have been the fact that the H females were able to maintain and adjust the bedroom temperature by changing the air conditioner setting depending on their sensations. This result was not in agreement with the previous result that among healthy elderly subjects at home, men attempted to change their clothing and room temperature during the daytime more than women (Iwashige, 1995). This discrepancy may be caused by differences in caregiving. In our study, it is clear that the care given to both male and female was almost equal if the ADL score was similar. However, in a previous study it was not clear whether or not the room temperature and number of clothing were controlled by the elderly themselves or by a member of their families. This indicates the importance of taking the family members of the elderly in account when conducting a survey.

The bed climate during the day was significantly lower for H females than the other groups. The difference between L males, L females and H females is not surprising as L males and L females have a low ADL. However, the most interesting finding was that H males exhibited the same temperature change as L males and L females. This indicates that H males tend to remain in bed during the day. During the survey, H females showed more interest in participating in club activities and in communicating with each other; in contrast, most of the H males did not, thereby resulting in their tendency to stay in bed.

There were no significant differences among the groups in the bed climate at night. All of the groups showed temperature and humidity value of around 33~35°C, and RH 50~60%, respectively which were near to the previously reported comfort bed climate zone of around 32~34°C, RH 45~55% (Miyazawa, 1974). As the subjective sleep evaluation was relatively good for all the groups, the above range is most likely the rough comfort bed climate zone for the elderly.

The number of bedding under the body increased significantly in L males and L females as they use more pads and cushions in order to avoid decubitus. The number of underwear significantly increased in H females. This result was in agreement with the findings of previous survey which showed that the elderly wear more layers of underwear during sleep compared to the young (Okamoto, 1993ab). On the other hand, the results for the other groups were similar to that of the young. This can be explained by the fact that the young caretaker changes and selects the clothing for these groups and that the clothing behaviour of the young caretaker was reflected in the number of underwear. This suggests the importance of taking the degree of caregiving in account when conducting surveys about the clothing behaviour of the elderly.

Subjective sleep evaluation was fairly good in all groups. The sleep onset was significantly higher, and the depth and satisfaction of sleep time showed a tendency to be higher in H females. H females did not stay in bed during the day and this may have been related to their good subjective sleep evaluation. This result indicates that although the ADL scores were the same, subjective sleep evaluation changed depending on daytime activity. It might be important to discourage H males from remaining in bed during the daytime in order to elevate their subjective sleep evaluation.

In conclusion, although there were no significant differences in bed climate at night, these results indicate that both ADL and gender may affect bedroom climate, and bed climate during the day, bedding and clothing condition, and subjective sleep evaluation. ADL and gender based differences should be taken into account with regard to the care of the elderly in a nursing home.

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References


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