Characterization and factors associated with sleep quality among rural elderly in China

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ABSTRACT

This article elucidates on sleep quality characterization and its associated factors among the Chinese elderly in the rural areas of Anhui province. We conducted a questionnaire survey on 2700 elderly individuals, from whom we obtained 2416 valid responses. The sleep quality, health-related quality of life (HRQoL), and functional status of the subjects were assessed using the Pittsburgh Sleep Quality Index (PSQI), Short Form–36 (SF–36), and Activities of Daily Living (ADL) scales. Body Mass Index (BMI) was obtained by measuring the height and weight of the subjects. The results showed that 49.7% of the participants slept poorly. Binary logistic regression analysis indicated that chronic disease, advanced age, low quantities of staple food (g), rice as major food, poor Physical Component Summary (PCS), poor Mental Component Summary (MCS), and significant dysfunction of ADL were predictors for poor sleep quality. However, no association was found between BMI and sleep quality. As half of the rural elderly in China were found to suffer from poor sleep quality, comprehensive measures should be undertaken to improve this situation.

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1. Introduction

Population aging has been a global concern since the late 20th century, and China is no exception. According to the Sixth Census data taken in 2010, 178 million Chinese are aged 60 or over, accounting for 13.26% of the total population. This number represents a 2.93% increase from the year 2000 (China National Census, 2011). As population aging continues, social economy and public health are faced with great challenges. One of these challenges facing the aging population in particular is poor sleep quality.

Sleep is a vital physiological process with important restorative functions (Crowley, 2011). However, significant quantitative and qualitative sleep-related changes occur as we age. In fact, Eser, Khorshid, and Cinar (2007) observed that 60.9% of the older people slept poorly. Chen, Yue, and Li (2006) also found that 49.9% of the elderly Chinese slept poorly. Several studies have demonstrated that sleep problems may lead to substantially impaired health, cognitive decline, and reduced quality of life (Bawden, Oliveira, & Caramelli, 2011; Gómez-Esteban et al., 2011). Thus, the sleep problems of the elderly are an important matter.

Poor sleep is caused by a variety of factors. Physical illness has been associated with sleep quality. Several studies have found that elderly individuals with chronic diseases are more likely to sleep poorly (Lurie, 2011; Marty et al., 2008). Recently, the influence of psychological factors on sleep quality has attracted considerable research interest. Spira, Stone, Beaudreau, Ancoli-Israel, and Yaffe (2009) suggested that elevated anxiety symptoms were independently associated with poor sleep. Paudel et al. (2008) found that depressive symptoms had a strong, graded association with subjective sleep disturbances. Social factors have been associated with sleep problems as well. Costa, Ceolim, and Neri (2011) noted that the elderly individuals who had reported having sleep problems received lower levels of social support than those that did not report such problems. In addition, lifestyle and nutrition also affect sleep problems. However, the associations between sleep problems and age and BMI remain unknown.

China is a distinct developing country. Its rural areas have larger aging populations than its cities, possibly a result of rapid urbanization and large-scale migration of younger adults to urban areas. This mass departure of young labor force has left many rural elderly with the burdens of heavy agricultural work and looking after grandchildren left behind by sons and daughters who have migrated to the city. These elderly left behind in rural villages may also experience loneliness and other negative emotions because of separation from their loved ones. Underdeveloped economies and failed heath care coverage may also contribute to various diseases.
and sleep disturbance among the elderly in rural areas. However, the sleep complaints of members of this demographic have been largely neglected or overlooked.

Most studies on sleep quality have focused on children, adolescents, and patients (Enderlin et al., 2011; Mesquita & Reimão, 2010; Paavonen, Porkka-Heiskanen, & Lahikainen, 2009). Thus, there is a lack of epidemiological studies on the rural elderly in China. In this study, we aimed to fill this knowledge gap. This cross-sectional study aimed to describe the sleep quality of the rural elderly from different socio-demographic statuses. We also examined the associations between sleep quality and age and BMI, as well as the influence of several factors on sleep quality.

2. Subjects and methods

2.1. Subjects

In our study, subjects were selected through a two-stage random sampling process. First, 3 of the 16 districts of Anhui Province, a large province in mid-east China, were randomly selected. Twenty villages were then randomly selected from each participating district using the stratified-cluster random sampling method. A total of 2700 subjects (aged ≥60) were sampled from these areas during the period of 2009–2010. Questionnaire-based face-to-face interviews were conducted and 2416 subjects completed the questionnaires, for an overall response rate of 89.5%. All respondents had signed written informed consent forms prior to being interviewed.

2.2. Measurement of the outcomes

2.2.1. Sleep quality

The PSQI is an instrument validated to assess sleep quality during the past month (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is a 19 item self-report questionnaire categorized into seven domains: sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each domain is given a score of zero to three and then combined for a total score ranging from 0 to 21. Higher scores indicate poorer sleep quality. The Chinese version of the PSQI defines poor sleep quality as having a total score greater than seven. The split-half reliability of the scale is 0.87; its sensitivity and specificity are 98.3% and 90.2% by the cut-off score of seven (Wang, Wang, & Ma, 1999).

2.2.2. HRQoL

SF-36 is widely used in various populations and under various conditions to collect data on HRQoL. The Chinese version of SF-36, which has been proven to be reliable and valid (Rui et al., 2011), scores eight domains: Physical Function (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE), and Mental Health (MH). Every domain is given a score from 0 to 100, with a higher score indicating better health. These eight domains can be divided into two summary scores: the MCS and the PCS (Lam, Tse, Gandek, & Fong, 2005).

2.2.3. Functional status

In our study, functional status was measured using the ADL scale, a 14-item scale that includes Physical Self-maintenance Scale (PSMS) and Instrumental ADL. Each item is coded on a four-point scale (1–4). A cutoff score of <16 is defined as normal function, 16 to 21 as declining function, and ≥22 (or two or more items greater than three) as significant dysfunction (Su et al., 2011).

2.2.4. Measurement of the BMI

Weight and height were measured following standardized procedures by trained Masters from the Anhui Medical University. BMI was determined based on these measurements and classified as underweight (<18.5 kg/m²), normal (18.5–24.0 kg/m²), overweight (24.0–28.0 kg/m²), or obese (>28.0 kg/m²), based on Chinese standards (Working Group on Obesity in China, 2004; Zhou, 2002).

2.2.5. Socio-demographic (or other) variables

Socio-demographic variables taken into account included sex, age, marital status (defined as married or unmarried (single, separated, or widowed)), living status (defined as living alone or non-alone), educational attainment (categorized into primary school and below, middle school, and high school and above) and annual individual income (categorized as non income earning, <3000 Yuan per year, and ≥3000 Yuan per year). Chronic disease conditions were based on final diagnosis from medical institutions, and included in the response options as a series of “YES” or “NO” items (hypertension, diabetes, coronary artery disease, hyperlipidemia, osteoarthritis, chronic gastrointestinal diseases, chronic bronchitis, cataracts, and cholelithiasis/cholecystitis). Nutrition variables included staple food (rice and pasta) and quantity of staple food (g) intake per day.

2.3. Ethical considerations

A cover letter explaining the purpose of the study was attached to the questionnaire. Consent was obtained from the participants through consent forms. All procedures were approved by the Ethics Committee of Anhui Medical University, Hefei, China.

2.4. Statistical analysis

All statistical analyses for this study were performed using Statistical Package for Social Science (SPSS) version 13.0 for Windows. The characteristics of the rural elderly were described as percentages of qualitative variables. Quantitative variables were described as means and standard deviations. χ² tests, t-tests and one-way analysis of variance (ANOVA) were performed to examine the differences between the characteristics of the participants and their sleep quality. Pearson binary correlations were used to identify the association between the HRQoL and sleep quality. Binary logistic regression analysis was applied to assess the factors influencing sleep quality.

3. Results

3.1. General data

Table 1 shows the demographic information of the participants. A total of 2416 rural elderly were interviewed in this survey, of whom 1169 (48.4%) were male and 1247 (51.6%) were female. The participants’ ages ranged from 60 to 98 years, with a mean of 68.44 ± 7.01 years. Among the participants, 67.4% were married and 74.0% were living with family members or others. A majority of the participants had received at least a primary school education (91.3%). In terms of economic status, 75.7% of the participants had no individual income or earned less than 3000 Yuan per year. Among the participants, 9.7%, 58.4%, 24.8%, and 7.2% were classified as underweight, normal weight, overweight, and obese, respectively, and 66.0% suffered from chronic disease.

3.2. Characterization of sleep quality

The PSQI total mean score was 7.68 (SD: 4.13), and poor sleepers accounted for 49.7% of the sample. The differences
between sleep quality and the general characteristics of the participants are likewise illustrated in Table 1. The difference was significant between sleep quality and different ages, levels of education, annual individual incomes, ADL, quantities of staple food, BMI, PCS and MCS. Among the participants, unmarried females who were living alone, had chronic diseases, and ate rice as their major food, experienced the worst sleep quality ($p = 0.000$).

The PSQI scores in each domain, shown in Table 2, show that sleep efficiency ranks the highest, followed by sleep latency and sleep disturbances. The use of sleeping medication domain received the lowest scores.

### 3.3. Sleep quality, age, and BMI

Different age groups exhibited statistical differences in terms of sleep quality. Table 2 shows that these differences exist in five domains of the PSQI ($p < 0.05$), except for sleep disturbances and use of sleeping medication, and that the scores tend to increase with age. These findings are typically suggestive of sleep problems being associated with age. As shown in Table 3, based on the specific conditions of items from the PSQI, 39.6% of the participants aged over 80 had fairly bad or very bad sleep quality, whereas the percentages of the 60–69 age groups and 70–79 age groups were 28.5% and 34.2%, respectively. The 60–69, 70–79, and over 80 age groups’ sleep latency scores were 34.74 (SD: 28.64), 39.18 (SD: 29.22), and 42.35 (SD: 37.01) min, respectively, and their sleep efficiency scores were 73.5%, 66.9%, and 63.4%, respectively. More sleep disturbances were seen in the higher age groups, with those aged over 80 years being more predisposed to sleep trouble resulting from failure to fall asleep within 30 min, waking up in the middle of the night or early morning, and getting up to go to the toilet at night, than the 60–69 and 70–79 age groups. In addition, the participants over 80 years old appeared to have more problems maintaining their enthusiasm to get things done.

Although BMI variation determined the statistical differences in sleep quality, sleep duration, sleep efficiency, use of sleeping

### Table 1
Baseline characteristics according to sleep quality ($n=2416$).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total</th>
<th>Poor</th>
<th>Good</th>
<th>t/$x^2$</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1169</td>
<td>498 (42.6%)</td>
<td>671 (57.4%)</td>
<td>45.796</td>
<td>0.000</td>
</tr>
<tr>
<td>Female</td>
<td>1247</td>
<td>703 (56.4%)</td>
<td>544 (43.6%)</td>
<td>22.198</td>
<td>0.000</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>68.44 ± 6.94</td>
<td>69.24 ± 7.01</td>
<td>67.62 ± 6.70</td>
<td></td>
<td>-5.786</td>
<td>0.000</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>788</td>
<td>446 (56.6%)</td>
<td>342 (43.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>1628</td>
<td>755 (46.4%)</td>
<td>873 (53.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-alone</td>
<td>1787</td>
<td>841 (47.1%)</td>
<td>946 (52.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>629</td>
<td>360 (57.2%)</td>
<td>269 (42.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>2206</td>
<td>1130 (51.2%)</td>
<td>1076 (48.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle school</td>
<td>160</td>
<td>53 (33.1%)</td>
<td>107 (66.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥High school</td>
<td>50</td>
<td>18 (36.0%)</td>
<td>32 (64.0%)</td>
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<td></td>
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<tr>
<td>Annual individual income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1000 Yuan</td>
<td>809</td>
<td>416 (51.4%)</td>
<td>393 (48.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥1000 Yuan</td>
<td>1019</td>
<td>553 (54.3%)</td>
<td>466 (45.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic diseases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>821</td>
<td>357 (43.5%)</td>
<td>464 (56.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1595</td>
<td>864 (54.2%)</td>
<td>731 (45.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity of daily living</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal function</td>
<td>1833</td>
<td>811 (44.2%)</td>
<td>1022 (55.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Declining function</td>
<td>251</td>
<td>133 (53.0%)</td>
<td>118 (47.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant dysfunction</td>
<td>332</td>
<td>257 (77.4%)</td>
<td>75 (22.6%)</td>
<td></td>
<td></td>
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<tr>
<td>Staple food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>1038</td>
<td>586 (56.5%)</td>
<td>452 (43.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pasta</td>
<td>1378</td>
<td>615 (44.6%)</td>
<td>763 (55.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity of staple food (g)</td>
<td>447.28 ± 177.91</td>
<td>417.34 ± 158.99</td>
<td>486.15 ± 193.20</td>
<td>5.964</td>
<td>0.000</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.65 ± 3.54</td>
<td>22.43 ± 3.53</td>
<td>22.87 ± 3.52</td>
<td>3.058</td>
<td>0.000</td>
</tr>
<tr>
<td>PCS</td>
<td>57.15 ± 22.52</td>
<td>50.44 ± 20.83</td>
<td>65.53 ± 21.77</td>
<td>10.775</td>
<td>0.000</td>
</tr>
<tr>
<td>MCS</td>
<td>64.93 ± 20.18</td>
<td>59.20 ± 19.52</td>
<td>72.08 ± 18.66</td>
<td>10.214</td>
<td>0.000</td>
</tr>
</tbody>
</table>

* Yuan is Chinese currency units; 1 Yuan is equal to 0.157 dollars.

### Table 2
Domain scores of sleep quality ($X ± S$).

<table>
<thead>
<tr>
<th>PSQI domains</th>
<th>Score</th>
<th>Age</th>
<th>60–69</th>
<th>70–79</th>
<th>80+</th>
<th>$F/x^2$</th>
<th>BMI (kg/m²)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;18.5</td>
<td>18.5–24.0</td>
<td>24.0–28.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;18.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep quality</td>
<td>1.21 ± 0.75</td>
<td>1.14 ± 0.75</td>
<td>1.30 ± 0.74</td>
<td>1.35 ± 0.80</td>
<td>14.43**</td>
<td>1.41 ± 0.82</td>
<td>1.23 ± 0.75</td>
<td>1.13 ± 0.74</td>
<td>1.12 ± 0.74</td>
</tr>
<tr>
<td>Sleep latency</td>
<td>1.33 ± 0.78</td>
<td>1.27 ± 0.72</td>
<td>1.40 ± 0.75</td>
<td>1.42 ± 0.84</td>
<td>3.906**</td>
<td>1.51 ± 0.80</td>
<td>1.31 ± 0.76</td>
<td>1.33 ± 0.79</td>
<td>1.22 ± 0.72</td>
</tr>
<tr>
<td>Sleep duration</td>
<td>1.07 ± 0.71</td>
<td>0.99 ± 0.54</td>
<td>1.17 ± 0.63</td>
<td>1.22 ± 0.73</td>
<td>7.911**</td>
<td>1.29 ± 0.75</td>
<td>1.09 ± 0.71</td>
<td>0.98 ± 0.65</td>
<td>1.01 ± 0.68</td>
</tr>
<tr>
<td>Sleep efficiency</td>
<td>1.66 ± 0.58</td>
<td>1.49 ± 0.64</td>
<td>1.85 ± 0.63</td>
<td>2.03 ± 0.60</td>
<td>29.358**</td>
<td>1.95 ± 0.69</td>
<td>1.67 ± 0.67</td>
<td>1.54 ± 0.49</td>
<td>1.50 ± 0.49</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>1.33 ± 0.57</td>
<td>1.32 ± 0.58</td>
<td>1.35 ± 0.55</td>
<td>1.30 ± 0.58</td>
<td>1.246</td>
<td>1.40 ± 0.55</td>
<td>1.31 ± 0.56</td>
<td>1.33 ± 0.58</td>
<td>1.36 ± 0.61</td>
</tr>
<tr>
<td>Use of sleeping medication</td>
<td>0.10 ± 0.44</td>
<td>0.06 ± 0.24</td>
<td>0.08 ± 0.32</td>
<td>0.09 ± 0.32</td>
<td>1.589</td>
<td>0.12 ± 0.41</td>
<td>0.05 ± 0.20</td>
<td>0.08 ± 0.30</td>
<td>0.15 ± 0.36</td>
</tr>
<tr>
<td>Daytime dysfunction</td>
<td>1.01 ± 0.48</td>
<td>0.97 ± 0.33</td>
<td>1.05 ± 0.52</td>
<td>1.14 ± 0.59</td>
<td>3.676</td>
<td>1.27 ± 0.28</td>
<td>0.99 ± 0.24</td>
<td>0.97 ± 0.35</td>
<td>0.99 ± 0.90</td>
</tr>
</tbody>
</table>

$* p < 0.05.$  
$** p < 0.01.$
Table 3
The items of sleep quality by age and BMI.

<table>
<thead>
<tr>
<th>PSQI items</th>
<th>Age</th>
<th>F / \chi^2</th>
<th>BMI (kg/m^2)</th>
<th>F / \chi^2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60-69</td>
<td>70-79</td>
<td>80+</td>
<td>&lt;18.5</td>
</tr>
</tbody>
</table>

- **Sleep quality**
  - Very good: 253 (18.2%) for 
    - F = 35.400** (p < 0.05)
  - Fairly good: 741 (53.3%) for 
    - F = 113 (48.3%)
  - Fairly bad: 337 (24.3%) for 
    - F = 71 (30.3%)
  - Very bad: 58 (4.2%) for 
    - F = 25 (10.7%)

- **Sleep latency**
  - 34.74 (28.64) for 
    - F = 3.312
  - 6.37 (2.05) for 
    - F = 2.790

- **Sleep efficiency**
  - 73.5 (34.79) for 
    - F = 11.771

- **Sleep duration**
  - 6.37 (2.05) for 
    - F = 2.790

- **Medication**
  - 2.05 for 
    - F = 2.05

- **PSQI items**
  - Had trouble sleeping because of a sleep latency greater than 30 min
    - 0 time/month: 715 (51.5%) for 
      - F = 15.627
    - <1 time/week: 241 (10.1%) for 
      - F = 19 (8.1%)
    - ≥3 times/week: 292 (23.7%) for 
      - F = 45 (19.2%)

- **Sleep quality**
  - Had trouble sleeping because of waking up in the middle of the night or early morning
    - 0 time/month: 302 (21.7%) for 
      - F = 21.393
    - <1 time/week: 119 (8.6%) for 
      - F = 16 (6.8%)
    - ≥3 times/week: 712 (51.3%) for 
      - F = 134 (57.3%)

- **Sleep quality**
  - Had trouble sleeping because of getting up to the toilet at night
    - 0 time/month: 493 (35.5%) for 
      - F = 20.468
    - <1 time/week: 141 (9.4%) for 
      - F = 16 (6.8%)
    - ≥3 times/week: 601 (43.3%) for 
      - F = 119 (50.9%)

- **Sleep quality**
  - Took medicine to help sleep during the past month
    - 0 time/month: 1343 (96.6%) for 
      - F = 9.613
    - <1 time/week: 23 (1.7%) for 
      - F = 5 (2.1%)
    - ≥3 times/week: 11 (0.8%) for 
      - F = 5 (2.1%)

- **Sleep quality**
  - Had a problem keep up enthusiasm to get things done
    - 0 time/month: 588 (42.3%) for 
      - F = 14.099
    - <1 time/week: 418 (30.1%) for 
      - F = 69 (29.5%)
    - ≥3 times/week: 102 (7.4%) for 
      - F = 37 (15.8%)

Note: The unit of sleep latency is minute; the unit of sleep duration is hour; the unit of sleep efficiency is percentage.

- p < 0.05
  - **p < 0.01

3.4. Correlation analysis between sleep quality and HRQoL

There were significant differences between PSQI total scores and the HRQoL domains (p = 0.000). The results suggested that poor PF (r = -0.374, p = 0.000), RP (r = -0.293, p = 0.000), BP (r = -0.249, p = 0.000), GH (r = -0.409, p = 0.000), VT (r = -0.408, p = 0.000), SF (r = -0.317, p = 0.000), RE (r = -0.211, p = 0.000), MH (r = -0.409, p = 0.000), PCS (r = -0.443, p = 0.000), and MCS (r = -0.384, p = 0.000) were correlated with poor sleep quality.

3.5. Binary logistic regression analysis of the sleep quality of the rural elderly

Table 4 shows the results of the binary logistic regression analysis adjusting for sex. Sleep quality (0 = high sleep quality, 1 = poor sleep quality) was the dependent variable, whereas sex (0 = male, 1 = female), age, marital status (0 = married, 1 = unmarried), living status (0 = non-alone, 1 = alone), educational attainment (1 = ≤primary school, 2 = middle school, 3 = ≥high school), individual income (0 = no income, 1 = < 3000 Yuan per year, 2 = ≥3000 Yuan per year), chronic disease (0 = no, 1 = yes), ADL (0 = normal function, 1 = declining function, 2 = significant dysfunction), staple food (0 = rice, 1 = pasta), quantity of staple food (g), BMI (kg/m^2), PCS (a higher score indicates better health), and MCS (a higher score indicates better health) were considered as independent variables. The results showed that variables such as chronic disease, ADL, staple food, age, quantity of staple food (g), PCS, and MCS entered the model. We found that the subjects who suffered from chronic diseases, were much older, had lower intake of staple food (g), ate rice as major food, had significant dysfunction in ADL, and had lower PCS and MCS scores experienced poor sleep quality.

4. Discussion

Nearly half of the participants in this study reported poor sleep quality, which suggests that poor sleep should be considered an important public health concern for this population. To further characterize whether age and BMI have any effects on sleep quality, we observed that age interfered with the sleep quality of this population. We also ascertained that the factors influencing sleep quality include chronic disease, ADL, type and quantity of staple food, PCS, and MCS. Therefore, three main aspects of this survey have to be addressed.
The total PSQI score was 7.74 ± 3.06, and 49.7% of the participants were poor sleepers. These findings indicate that poor sleep quality is prevalent in the rural Chinese elderly, which is consistent with the findings of previous studies in China. Qu et al. (2011) studied 2500 Chinese elderly over a period of 63 years and reported a total PSQI score of 7.24 ± 3.25, as well as 50.11% occurrence of poor sleep quality. Similarly, Zhao and Hu (2011) reported a sleep disorder occurrence rate of 67.2%. Possible explanation for this high ratio of poor sleep are the insufficient medical care service in the rural areas of China, a lack of awareness among the elderly of the importance of consulting a doctor regarding their ailments, and ignorance of the importance of high-quality sleep. Although it is inadvisable for us to describe the conditions in China by referring to the results of studies conducted in other countries owing to differences in sleep quality cut-off scores and assessment tools used (Andruskiene, Varoneckas, Martinikas, & Grabauskas, 2008; Beland et al., 2010), we cannot deny the fact that sleep disturbance is indeed prevalent among older adults worldwide. In our findings regarding the seven components of PSQI, sleep efficiency was ranked first, followed by sleep latency and sleep disturbances. The most likely interpretation of these results is that the majority of the elderly were suffering from loneliness, isolation, and other emotions when they entered their old age (Murphy, 2006). Particularly, the negative emotions interfered with the sleep quality and sleeping patterns of the aged, leading to longer sleep latency and reduced sleep efficiency. Further, the use of sleeping medication component received the lowest score in this survey, which can be attributed to poor provision of health care services and health education in rural areas.

Older adults were found to experience increased sleep problems resulting from changes associated with aging, including longer sleep latency, shorter sleep duration, and lower sleep efficiency. One possible reason for this increase is a phase advance in the normal circadian sleep cycle, that is, older people tend to go to sleep earlier in the evening and wake earlier (Wolkove, Elkholly, Baltzan, & Palayew, 2007). However, this hypothesis was rejected by some physicians who considered the association between sleep and age to coexist with medical illness (Ancioli-Israel, 2005). Bliwise et al. (2009) described nocturnia to be a frequently overlooked cause of poor sleep in the elderly. This view appears to be reliable because our survey also suggested that the occurrence of getting up to go to the toilet at night increased with age. However, because the results were inconsistent, it is very important to distinguish what is part of the aging process and what it is abnormal in the elderly population. The prevalence of sleep disturbances tends to be inflated because many studies fail to make this important distinction. Ohayon, Carskadon, Guilleminault, and Vitiello (2004) stated that small sample sizes and inconsistency in controlling factors may influence results. Accurate results in our future studies can be ensured by using paired design or controlling factors that may influence sleep (such as mental or physical illness) in the analysis phase to decrease the prevalence of sleep disturbances.

Interestingly, we found no relationship between sleep quality and BMI. Obesity has recently become a major public health issue, and the effect of obesity on sleep has produced a great deal of interest within the scientific and medical community. Many studies have associated obesity with impaired sleep duration (Garaulet et al., 2011; Patel et al., 2008), although other prospective study did not hold the same view (Strangues et al., 2008). Our results were consistent with the prospective findings as well as conclusions drawn by Zhou et al. in their investigation of Chinese longevity (this article is an epub ahead of print on Age (Dordr)). We attribute these contradictory conclusions to the lower BMI baseline for the Chinese population in comparison with those of Western countries.

The current study’s correlation analysis found sleep quality to be negatively correlated with each component of the SF-36, that is, poorer health-related quality was correlated with poorer sleep quality among the rural Chinese elderly. Similar results have been found by several studies (Eser et al., 2007; Mystakidou et al., 2007), further indicating that improved sleep quality could result in improved health quality. In the current study, we observed the highest correlation coefficient among all the SF-36 domains in general health and mental health (r = −0.409), indicating that general and mental health had a close relationship with sleep quality.

The major finding of our study was that health conditions, such as chronic diseases and PCS, were associated with sleep quality. Several studies have associated sleep problems with the presence of chronic disease, such as heart disease, hypertension, stroke, and nocturia (Bliwise et al., 2009; Walters & Rye, 2009). Hayashino et al. (2010) found that the global PSQI score increased as the number of co-morbid conditions increased. However, our survey on chronic diseases only included hypertension, diabetes, coronary artery disease, hyperlipidemia, osteoarthritis, chronic gastrointestinal diseases, chronic bronchitis, cataracts, and cholelithiasis/cholecystitis. With the reported high occurrence of getting up to visit the toilet at night (>3 times/week), nocturia should also be considered in related studies. Most studies consider that poor health is a risk factor for poor sleep quality. However, the causal direction is difficult to establish. The health status of an individual is an influencing factor for sleep problems that may adversely impact an individual’s health, and the relationship may be bidirectional and complex. We also found that normal ADL
function contributed to high sleep quality. The reason for this was that the normal function of activities was often part of the individual's sleep ritual. Significant dysfunction of activities probably impaired the sleep quality. These findings were in agreement with those of Zisberg, Gur-Yaish, and Shochat (2010) whose study associated sufficient maintenance of daily routines with a reduced rate of insomnia in the elderly.

Furthermore, the current results suggested that MCS was linked to sleep quality, and therefore poor MCS could indicate poor sleep quality. As China continues its rapid urbanization, the demand for labor forces in urban cities attracts large numbers of young adults seeking their fortunes in urban areas. Most of these migrant workers only return home during the traditional Chinese Spring Festival. Long separation and insufficient communication with their sons or daughters could make the rural elderly feel isolated, resulting in negative emotions and other psychological problems that further lessen their sleep quality. The influence of psychological factors on sleep quality has been confirmed by various studies (McHugh, Casey, & Lawlor, 2011; Paudel et al., 2008; Spira et al., 2008). Although our research revealed that psychological problems can influence sleep quality, our study did not cover wider psychological aspects than the MCS. Thus, future studies should place emphasis on psychological issues such as depression and anxiety.

We further observed that nutrition was associated with sleep quality. Multivariate analysis showed that for participants with rice (as opposed to pasta) as their major staple food, those participants with lower staple food intake were poorer sleepers. This could be because pasta is better for digestion, which can help the rural elderly to sleep better and more easily. Lower quantities of staple food provided insufficient energy, which may impair sleep quality. However, this result differed from those of other studies. Sato-Mito, Shibata, Sasaki, and Sato (2011) suggested that a later sleep midpoint is significantly associated with lower energy, and a higher intake of noodles. This causative difference seems beyond interpretation and is yet to be determined.

Before drawing conclusions, several limitations of this study should be acknowledged. The cross-sectional data limited the interpretation of the results; this can be resolved by using longitudinal studies to further determine the causation. Our data were collected via face-to-face interviews, and therefore misunderstandings resulting from interviewees' dialects and poor educational backgrounds were inevitable. Moreover, subjective assessment of the sleep quality may affect the validity of the results to a certain degree. Thus, the use of objective approaches in the assessment of sleep should be considered in future studies. Finally, the description of sleep characterization depended only on times per week. As a result, we could not determine how much sleep disturbances are of significance.

5. Conclusion

Relatively few studies have been conducted on sleep quality among the Chinese elderly. Hence, this work enriches the understanding of sleep quality in China. Our findings revealed that nearly half of the Chinese rural elderly suffer from poor sleep quality, and that the influencing factors involved include age, physical and mental health, and nutrition. These factors can be addressed by providing comprehensive interventions. Despite the limitations of this study, it is still an important step in presenting the characterization and factors influencing the sleep quality of the rural Chinese elderly.

Conflict of interest statement

None.

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