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Determinants of Sleep Quality in Patients with Type 2 Diabetes Mellitus in Aceh Tengah, Indonesia

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Abstract

Background: Sleep quality is the feeling of freshness and well-being that individuals feel when they wake up. Poor sleep quality in patients with type 2 diabetes mellitus will affect glucose homeostasis, decreased insulin sensitivity, glycemic control and metabolic decompensation. This study aims to determine the determinants of sleep quality in patients with type 2 diabetes mellitus in Aceh Tengah, Indonesia.

Methods: This study is qualitative with a cross sectional design. Data were collected from 210 respondents from October 17-December 19, 2022. Data collection tools comprised demographic characteristics questionnaire,

Pittsburgh Sleep Quality Index questionnaire and The Summary Diabetes Self-Care Activities questionnaire.

Results: Analysis with the Chi-square test showed that there was a significant relationship between diet/eating patterns ($p = 0.000$) with sleep quality in patients with type 2 diabetes mellitus.

Conclusions: Health education in the form of education about sleep quality and diet in patients with type 2 diabetes mellitus with leaflet / booklet media and videos that are easy to understand, will increase patient knowledge and can be used as a routine education program in hospitals.

Keywords: Sleep Quality, Diabetes Mellitus, Education, Nurses, Hospitals

1. Background

Sleep quality is one of the domains of sleep. It can be interpreted that a person's sleep quality is sufficient as a feeling of freshness. Inadequate sleep quality can lead to sleep deprivation, which can cause various symptoms and signs [1]. Sleep quality is the state of freshness and well-being resulting from sleep that individuals experience upon waking. Sleep processes and conditions during optimal sleep describe a person's good sleep quality [2].

Good sleep quality in patients with diabetes mellitus (DM) can help the pancreas function in regulating blood sugar levels [3], improve individual blood glucose control and insulin resistance significantly [4], and decrease risks and complications such as death, myocardial infarction, as well as a microvascular complication [5].

Poor sleep quality allows patients with diabetes mellitus to experience metabolic decompensation [3], have poorer glycemic control [6], affect glucose homeostasis [4] and decrease insulin sensitivity, increase fasting plasma glucose, and raises HbA1c [5].

About 70% of adults in America report poor sleep quality each month, and sleep-related problems affect about 50-70 million people [7]. Research in Jordan on 1,211 patients found that 81% of patients with type 2 diabetes mellitus had poor sleep quality [8]. A study of 20,884 Chinese population found 21.0% with poor sleep quality in urban samples and 15.9% with poor sleep quality in rural samples [9]. Research on 199 patients in Singapore found that 108 patients reported poor sleep quality while 91 patients reported good sleep quality [10].

Various factors are believed to affect the sleep quality of patients with diabetes mellitus, including age, gender, marital status, diet, and physical activity [8, 11, 12, 13]. The lack of education and reporting on sleep quality in patients with type 2 diabetes mellitus (T2DM) makes researchers want to reconfirm what determinants are associated with sleep quality in patients with type 2 diabetes mellitus in Aceh Tengah, Indonesia.

2. Materials and Methods

This research design uses descriptive correlation with a cross-sectional approach. The sample amounted to 210 people, namely outpatients at Datu Beru General Hospital in Aceh Tengah who suffered from T2DM, aged ≥ 20 to > 65 years, with a duration of DM ≥ 2 years. Patients were excluded if they had severe complications, hearing loss, and physical limitations. This study

was conducted in October-December 2022. Data were collected using a measuring instrument in the form of a sociodemographic questionnaire, in the form of respondents' initials, age, gender and marital status. The Pittsburgh Sleep Quality Index (PSQI) questionnaire was developed by Buysse *et al.*, (1989). The PSQI is designed to provide a standardized and easy-to-use index for clinicians and patients to measure sleep quality. The questionnaire measures sleep quality over a 1-month interval and consists of 10 questions to measure 7 sleep components. Each component has a score from 0-3. The total score is the sum of the 7 component scores, ranging from 0 to 21 [14]. In this study, the Indonesian version of the PSQI was used, with a cutoff point of 6, to characterize poor sleep (≥ 6) from good sleep (< 6) [15].

The SDSCA (The Summary Diabetes Self-Care Activities) questionnaire was adapted from the research of Toobert *et al.*, (2000). The SDSCA is a brief self-report questionnaire to measure the level of diabetes self-management that includes items to assess aspects of diabetes-related issues. The SDSCA contains 25 items related to diet, medication, foot care, physical activity, self-monitoring of blood glucose, smoking, and provider self-care recommendations [16]. For diet/eating patterns scoring, a score < 2.75 indicates poor diet, and for physical activity, a score < 1.5 indicates poor physical activity. In this study, the Indonesian version of the SDSCA was used to determine respondents' dietary habits and physical activity during the last 1 week [17].

The statistical analysis was performed using a computer program. Descriptive statistics, including frequencies and percentages of each group of variables. Testing for statistical significance to determine whether there was an association was done using the Chi-square test.

3. Results

Table 1. A total of 210 patients with T2DM participated in this study with a 100% response rate. 74.8% of the patients were in the early-late elderly (46-65 years old), female (66.7%), marital status with a partner (82.4%), the lifestyle of respondents in diet/eating pattern is not good (55.2%) and for physical activity is good (55.2%). Most of respondents had poor sleep quality (57.1%).

Table 1: Frequency Distribution of Demographic Characteristics of T2DM Patients (n = 210)

| S. No | Demographic Characteristics | Frequency | Percentage |
|-------|----------------------------------|-----------|------------|
| 1 | Age | | |
| | Early - late adulthood | 23 | 11.0 |
| | Early - late elderly | 157 | 74.8 |
| | Old age | 30 | 14.3 |
| 2 | Sex | | |
| | Male | 70 | 33.3 |
| | Female | 140 | 66.7 |
| 3 | Marital status | | |
| | With a partner | 173 | 82.4 |
| | Without a partner | 37 | 17.6 |
| 4 | Lifestyle (diet/eating patterns) | | |
| | Poor | 76 | 36.2 |
| | Good | 134 | 63.8 |
| 5 | Lifestyle (physical activity) | | |
| | Poor | 94 | 44.8 |
| | Good | 116 | 55.2 |
| 6 | Sleep Quality | | |
| | Poor | 120 | 57.1 |
| | Good | 90 | 42.9 |

Table 2. Poor sleep quality was found in respondents with early-late elderly (61.1%), male (61.4%), marital status with a partner (58.4%), poor diet (77.6%) and good physical activity (58.6%). The bivariate analysis found that variables associated with sleep quality in T2DM patients were diet/eating patterns ($p = 0.000$).

Table 2: Relationship between Demographic Characteristics, BMI, BGL, DM Drug Use, Lifestyle with Sleep Quality in T2DM Patients (n = 210)

| S. No | Demographic Characteristics | Sleep Quality | | | | | | P-value |
|-------|-------------------------------|---------------|------|------|------|-------|-----|---------|
| | | Good | | Poor | | Total | | |
| | | f | % | f | % | f | % | |
| 1 | Age | | | | | | | 0.127 |
| | Early - late adulthood | 13 | 56.5 | 10 | 43.5 | 23 | 100 | |
| | Early - late elderly | 61 | 38.9 | 96 | 61.1 | 157 | 100 | |
| | Old Age | 16 | 53.3 | 14 | 46.7 | 30 | 100 | |
| 2 | Sex | | | | | | | 0.460 |
| | Male | 27 | 38.6 | 43 | 61.4 | 70 | 100 | |
| | Female | 63 | 45 | 77 | 55 | 140 | 100 | |
| 3 | Marital status | | | | | | | 0.548 |
| | With a partner | 72 | 41.6 | 101 | 58.4 | 173 | 100 | |
| | Without a partner | 18 | 48.6 | 19 | 51.4 | 37 | 100 | |
| 4 | Lifestyle (diet) | | | | | | | 0.000 |
| | Poor | 17 | 29.3 | 82 | 70.7 | 116 | 100 | |
| | Good | 56 | 59.6 | 38 | 40.4 | 94 | 100 | |
| 5 | Lifestyle (physical activity) | | | | | | | 0.733 |
| | Poor | 42 | 44.7 | 52 | 55.3 | 94 | 100 | |
| | Good | 48 | 41.4 | 68 | 58.6 | 116 | 100 | |

4. Discussion

From the results of this study, no association was found between poor sleep quality and age. This finding is in line with several other studies, where age is an important factor affecting sleep quality. However, age is not a significant factor in either poor nighttime sleep or excessive daytime sleepiness [18, 19]. Different from the research of Shamshirgaran *et al.*, and Darraj *et al.*, found an association between age and sleep quality. Age-related sleep changes may make sleep less efficient [11, 20].

In this study, there were more female patients than male patients. However, it is not related to determining sleep quality. This is supported by other studies that there is no relationship between gender and the sleep quality of T2DM patients [21, 11, 19]. But in contrast to other studies that state there are differences in sleep quality in both sexes [20, 8, 9].

Marital status differences in sleep quality suggest that married individuals benefit from marriage through greater resources. Having a bedmate can increase security and comfort, allowing one to relax and fall asleep. In contrast, marital breakdown causes stress, which in turn disrupts sleep [22]. In this study, there was no relationship between marital status and sleep quality in patients with T2DM. The same results were found in other studies that did not find a statistical relationship between marital status and sleep quality [21, 11, 23]. Not in the same direction as this study, a significant relationship was found between marital status and sleep quality [8, 24, 9].

The results showed that diet/eating patterns with sleep quality had a significant relationship. The type of diet also has a significant relationship with sleep quality. Some types of food can affect the quantity and quality of sleep. Food products high in caffeine, such as coffee, cola, and chocolate, serve as stimulants that affect natural sleep

patterns [25]. An important relationship has been identified between the quality of ingested carbohydrates (product fiber content and degree of food processing) and sleep quality. The glycemic index and the frequency and timing of meals are influenced by carbohydrate intake and the quality of carbohydrates consumed [26].

Among modifiable lifestyle factors, smoking, alcohol consumption, and low-fiber and/or high-sugar diets increase susceptibility to insulin resistance. Especially some types of carbohydrates have important effects on the development of insulin resistance due to their high glycemic index among other nutrients [12]. To avoid disease complications, diabetic patients should control their blood glucose and maintain a healthy lifestyle, one of which is a healthy diet [27]. However, in addition to, prevention through a healthy lifestyle based on dietary patterns alone may not be enough and should always include physical activity as an integral part [28].

The High Authority of Health (HAS) makes therapeutic education an essential component for diabetes management, through improving psychosocial, lifestyle, clinical outcomes, increasing knowledge and skills, and changing patient behavior. T2DM is significantly related to nutrition and lifestyle. A healthy diet, physical activity, medication, regular screening, and treatment of complications can avoid or delay relevant complications. Educational programs in the form of education have a significant effect on patients' knowledge about the disease, especially about nutrition. Such structured education programs should be implemented and monitored as part of diabetes treatment. It is also possible to reduce the cost of disease management and also improve the quality of life of patients [29].

Individual nutrition education can impact the prevalence of T2DM by increasing the level of knowledge. As most of the subjects are elderly from a nutritionist's point of view, patients with T2DM find it difficult to remember lectures on individual nutrition education topics. Therefore, it is very important to provide appropriate tools. According to diabetes health education in Portugal and China, and the perspective of patients with T2DM in Indonesia, the use of booklets is appropriate in providing individual nutrition education in Indonesia. Patients with T2DM are not familiar with the use of Android for online individual nutrition education. Booklets can address the needs of all patients with T2DM questions during individual nutrition education and practice in their homes. Booklets are also appropriate in delivering individual nutrition education in Indonesia [30].

For the relationship between physical activity and sleep quality in this study, there was no significant relationship. This is in line with the research of Lee *et al.*, which found that physical activity was not statistically associated with sleep quality [31]. In contrast to other studies, which revealed that physical activity has a significant relationship with poor sleep quality. Sleep disorders lead to reduced alertness, daytime hypersomnolence, and impaired cognition [32, 33]. Patients who are inactive or have low physical activity can also be 4.13 times more likely to have poor sleep quality than those with moderate physical activity [13].

Exercise is important in assisting diabetes control by improving fitness, blood glucose levels, and insulin sensitivity [27]. The sleep quality of the elderly is not related to physical fitness but physical activity. Moderate to intense physical activity is mainly associated with improved sleep quality [34]. Being more active results in improved sleep efficiency, longer sleep duration, and less delay in falling

asleep [35].

5. Conclusions

Based on the results of this study, it can be concluded that the lifestyle associated with sleep quality in T2DM patients is diet/eating patterns. Independence, compliance, and health education in the form of education about sleep quality and diet/eating patterns in T2DM patients with leaflet/booklet media and videos that are easy to understand, will increase patient knowledge and can be used as a routine education program in the hospital.

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