



# Mediating Roles of Stress, Anxiety, and Depression in the Relationship between Constipation and Sleep Quality among the Elderly: Structural Equation Modeling (SEM)

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## Abstract

**Introduction** Sleep quality is an important health index in the elderly. As age increases, changes occur in sleep quality leading to sleep disorders and recurrent complaints. Sleep quality management of the elderly requires identification of its determinants. The present study aimed to determine the mediating roles of stress, anxiety, and depression in the relationship between constipation and sleep quality among the elderly using structural equation modeling (SEM).

**Materials and Methods** A correlational design was used in the present study through structural equation modeling. In this work, 363 elderly were examined by multi-stage random sampling. Data collection tools included four questionnaires, namely a demographic information questionnaire, the constipation questionnaire (ROME III), the Depression, Anxiety, and Stress Scale-short form, and the Pittsburgh Sleep Quality Index (PSQI), which were completed by interview and the self-report method. The SPSS Statistics for Windows, version 22.0, and SPSS AMOS (IBM Corp., Armonk, NY, USA) were used to analyze the data.

**Results** The results indicated that the proposed model had an acceptable fit ( $p < 0.000$ , root mean square error of approximation [RMSEA] = 0.062, comparative fit index [CFI] = 0.83, goodness-of-fit index [GFI] = 0.87, and  $\chi^2/df = 1.94$ ). The fitted model could explain 60% of the sleep quality variance. According to the proposed model, constipation could significantly predict sleep quality due to the mediation of stress, anxiety, and depression ( $p < 0.05$ ).

**Conclusion** The constructs of this model (constipation, stress, anxiety, and depression) can be used as a reference framework to design effective interventions and improve sleep quality in old people.

## Keywords

- ▶ sleep
- ▶ constipation
- ▶ anxiety
- ▶ depression

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## Introduction

The importance of sleep for the overall health of the elderly has been increasingly identified.<sup>1</sup> Sleep quality is an important health index in old people.<sup>2</sup> Low-quality sleep is the third main health problem of the elderly after headaches, and gastrointestinal disorders.<sup>3-5</sup> In Iran, 67% of the elderly suffer from sleep disorders, 61% of whom have insomnia.<sup>6</sup> Moreover, 82.6% of retirees participating in a survey had poor sleep quality.<sup>7</sup> It should be noted that the main cause of sleep problems is not biological changes in circadian rhythms in the elderly, however, it is the diseases, effects of drugs, depression, and anxiety, and low movement.<sup>8</sup> Sleep disorders are associated with a higher risk of death, cardiovascular diseases, quality of life disorders (QOL), and falling.<sup>5,9-11</sup> Sleep problems can affect “self-perception” in the elderly, which determines the effective function and behavior of an individual while affecting their quality of life (QOL).<sup>8</sup> There is a U-shaped connection between sleep and health problems as the decrease and increase in sleep hours cause various health problems for a person.<sup>12</sup> Understanding the above-mentioned issues is essential to assess the sleep quality in the elderly and its effective factors to improve the sleep quality.

Sleep disorder is a common symptom in patients with chronic constipation.<sup>13</sup> Constipation is a common and significant health problem causing negative effects on the quality of life in the elderly.<sup>14</sup> It is a prevalent cause of patients’ referral to general practitioners and internists. Constipation is prevalent in 64% of adults over the age of 65 in Iran. Constipation can also lead to long-term complications such as hemorrhoids and psychological problems.<sup>15</sup> People with constipation experience a huge deal of negative emotions since constipation and difficulty in defecation can make them stay at home. Furthermore, avoidance from expressing or pursuing treatment due to shame and shyness doubles stress, anxiety, and depression.<sup>16</sup> Straining during defecation can impair blood flow to the coronary and the brain arteries and cause ischemia and syncope in the elderly.<sup>17</sup>

Studies indicate that sleep disorders, depression, and anxiety can be associated with constipation.<sup>13</sup> There is a relationship between sleep and stool consistency in elderly patients. It is interesting to assess whether long-term improvement in these factors can have a positive effect on other factors.<sup>18</sup> The researchers found that patients with normal sleep duration were less likely to have constipation than those with short and long sleep periods. Shorter sleep duration is associated with a 38% increased risk of constipation. The risk of constipation in patients with prolonged sleep duration was 61% compared with those with normal sleep duration.<sup>19</sup>

Psychological and emotional factors such as depression and anxiety can interfere with sleep.<sup>20,21</sup> Approximately 50% of the elderly with chronic insomnia have underlying psychiatric illnesses, such as depression and anxiety.<sup>22</sup> Stress has a potentially severe effect on adults’ health and causes

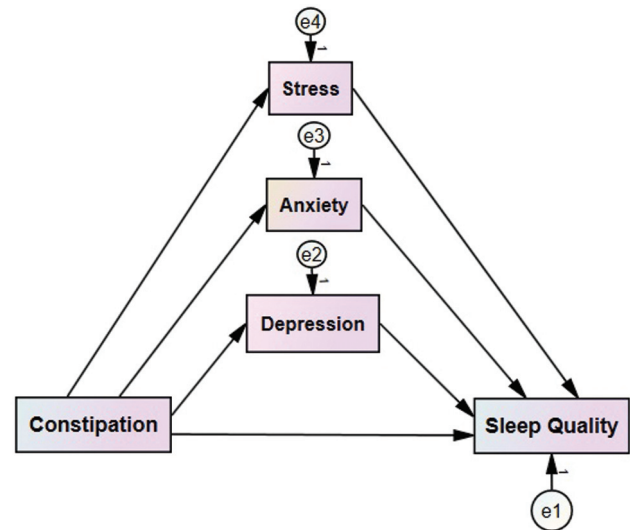


Fig. 1 The proposed research model.

psychological stress.<sup>23</sup> Depression is more common in the elderly than in the general public, with a prevalence of 25 to 50% in various studies. In this age group, depression is not well diagnosed because it is associated with physical complaints, such as insomnia or irregular sleep, compared with depression in young people.<sup>24</sup>

The present model was designed and tested considering the importance of elderly health and the relationship between psychological variables such as depression, anxiety, stress, and sleep quality. Moreover, few studies have examined the relationship between constipation and sleep quality in the elderly in Iran. Thus, the present study aimed to design and test a model in which constipation was considered as an independent variable, sleep quality as a dependent variable, and stress, anxiety, and depression as mediating variables. The model proposed in this study is presented in Fig. 1. In this work, it was attempted to better understand the complex effects of constipation on sleep quality and to provide a reference for future group research.

The equivalent statistical model can be written as below:

$$\text{sleep quality} = \beta_{11}\text{depression} + \beta_{12}\text{anxiety} + \beta_{13}\text{stress} + \beta_{14}\text{constipation} + \varepsilon_1$$

$$\text{depression} = \beta_{21}\text{constipation} + \varepsilon_2$$

$$\text{anxiety} = \beta_{31}\text{constipation} + \varepsilon_3$$

$$\text{stress} = \beta_{31}\text{constipation} + \varepsilon_4$$

Considering the above concerns, the present study began with the following hypotheses: Hypothesis 1 (H1) - Constipation is positively and directly related to sleep quality. Hypothesis 2 (H2) - Constipation is positively and directly related to stress, anxiety, and depression. Hypothesis 3 (H3) - Stress, anxiety, and depression have a direct and positive relationship with sleep quality. Hypothesis 4 (H4) -

Constipation is positively and indirectly related to sleep quality through stress, anxiety, and depression.

## Material and Methods

### Procedure

The present study presents a correlational design through structural equation modeling (SEM). It was conducted with the multi-stage random sampling method among the elderlies referred to health centers in Izeh County (located in the Khuzestan province) in 2020. The G POWER software (Izeh, Khuzestan, Iran) was used to measure the sample size, which was 363 based on the effect size of 25%, and power of 80%. The inclusion criteria of the present study were patients aged 60 years and older, ability to speak, and no memory impairment. The unwillingness to continue participating in the study was the exclusion criterion.

### Measurement Tools

In the present study, data collection tools included four questionnaires, namely a demographic information questionnaire, a constipation questionnaire (ROME III), the Depression, Anxiety, and Stress Scale-short form (DASS), and the Pittsburgh Sleep Quality Index (PSQI). The questionnaires were completed by interviews and self-report.

The demographic information questionnaire consisted of nine questions examining the participants' demographic characteristics (age, sex, education level, job status, number of children, and place of residence of the children).

The constipation questionnaire (ROME III) with eight questions was used to assess the participants' constipation status. The validity and reliability of this questionnaire were confirmed and measured on a 5-point Likert scale (never, sometimes, very often, most of the time, always).<sup>25</sup>

The DASS was used to assess the participants' depression, anxiety, and stress, for which the validity and reliability were confirmed.<sup>26,27</sup> The questionnaire consisted of 21 questions measuring 3 fields (stress, anxiety, and depression). Each field consisted of 7 questions, each scored from zero (it is never true for me) to 3 (absolutely true).

The PSQI was used to assess participants' sleep quality, and its validity and reliability were also confirmed.<sup>28</sup> The questionnaire consisted of 19 questions and 7 fields (mental sleep quality, delay in falling asleep, sleep duration, sleep efficiency, sleep disorders, use of sleeping pills, and daily functional disorders) to assess the sleep quality over the previous month. Each question was scored on a 4-point Likert scale from 0 to 3.

### Ethical Considerations

The present study was approved by the ethics committee of Behbahan University of Medical Sciences (IR.BHN.REC.1400.007). Before the research, its objectives were sufficiently explained to the participants, who were assured of the confidentiality of their personal information. The partic-

ipants were also informed that participation was voluntary and they could withdraw from the study at any time.

### Data Analysis

In the present study, data analysis was performed with the SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA) software using descriptive and inferential statistics. The goodness of fit, as well as the predictive variance of sleep quality, were assessed by path analysis using the SPSS AMOS (IBM Corp). Path analysis is an expansion of multiple regression. The goal of path analysis is to estimate the magnitude and significance of hypothesized association between sets of variables as depicted in a path diagram.<sup>29,30</sup> Therefore, we used path analysis to analyze the data because it was completely consistent with the purpose of the study. The relevant indices were calculated in the analysis, including the ratio of chi-square to the degree of freedom ( $\chi^2/df$ ), the goodness-of-fit index (GFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). The ratio of chi-square to the degree of freedom ( $\chi^2/df$ ) is used as an indicator to measure the appropriateness of the model fit. If this index is lower than 2 or 3, the model is better in terms of this criterion. The GFI index answers the question "How much does the resulting model perform better than the worst model?" Appropriate fitness of model is 0.90 or higher for the GFI. The normed fit index (NFI) is used to compare models, and a value greater than 0.95 indicates a better model. The RMSEA criterion measures the appropriateness of the statistical population. If this index is lower than

**Table 1** The descriptive statistics of demographic information of the participants in the study.

Gender	Level	Number (%)
Gender	Male	181 (49.86)
	Female	182 (50.14)
Education level	Illiterate	213 (58.68)
	Primary school	110 (30.3)
	High school	15 (4.13)
	Diploma	18 (4.96)
	Academic	7 (1.93)
Employment status	Employed	16 (4.41)
	Unemployed	347 (95.59)
Smoking	Yes	154 (42.42)
	No	209 (57.58)
Distance of children's residential place	> 20 km	95 (26)
	< 20 km	268 (74)
Number of children	No children	5 (1.38)
	1 child	6 (1.65)
	2 children	30 (8.26)
	3 children	92 (25.34)
	4 children	111 (30.58)
	More than 5 children	25 (6.89)

**Table 2** The frequency distribution of depression, anxiety, and stress in the participants.

Type of disorder	Depression		Anxiety		Stress	
Degree	Number	Percentage	Number	Percentage	Number	Percentage
Normal	292	81.1	281	78.1	304	84.4
Mild	15	4.2	11	3.1	14	3.9
Moderate	24	6.7	15	4.2	42	11.7
Severe	29	8.1	17	4.7	0	0
Very severe	0	0	36	10.0	0	0

**Table 3** The frequency distribution of constipation and sleep quality in the participants.

Type of disorder	Level	Number	Percentage
Constipation	No	296	82.2
	Yes	64	17.8
Sleep quality	Normal	198	55.0
	Bad sleep	162	45.0

0.05, the model is better. A significance level of < 0.05 was considered in the present study.

### Results

► **Table 1** presents the individuals' demographic characteristics. The mean (standard deviation) age of participants was 70.05 (5.4).

► **Table 2** presents the frequency distribution of different degrees of depression, anxiety, and stress in the participants. In the present study, the prevalence of depression, anxiety, and stress was 19%, 22%, and 15.6%, respectively. Furthermore, the prevalence of constipation and sleep disorders was 17.8% and 45%, respectively (► **Table 3**).

The results of the path analysis of the indices of the model indicated the good fit of the model.

**Table 4** The goodness of fit index of the path analysis model.

Index	Value
$\chi^2/df$	1.94
GFI	0.87
CFI	0.83
NFI	0.85
IFI	0.71
RMSEA	0.062
PNFI	0.66
AIC	729.7
Variance cover percentage	60

Abbreviations: AIC, Akaike's information criterion; CFI, comparative fit index; IFI, incremental fit index; GFI, goodness-of-fitness index; NFI,

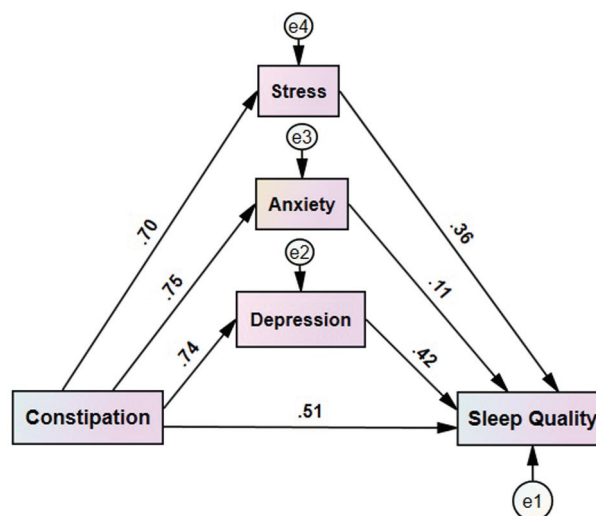
( $\chi^2/df = 1.94$ , GFI = 0.87, CFI = 0.83, RMSEA = 0.062,  $p < 0.001$ )

Moreover, the results of the path analysis indicated that the fitted model could explain 60% of the sleep quality variance (► **Table 4**, ► **Fig. 2**).

The path analysis results indicated that:

- \* Constipation construct had a direct positive and significant effect on the reduction of sleep quality. In other words, the higher the severity of constipation, the lower the sleep quality so that an increase of 10 units in constipation reduced the sleep quality by 5.8 units.
- \* Constipation also had a statistically significant effect on sleep quality by simultaneous effects on depression, anxiety, and stress so that an increase of 1 unit in constipation simultaneously enhanced depression by 1.12 units, anxiety by 1.2 units, and stress by 0.99 units.

A deeper look at the mediating roles of depression, anxiety, and stress confirms the existence of statistically significant effects of these mediators. Assuming anxiety and stress as constants, a 10-unit increase in depression results in a 3.2-unit reduction in sleep quality. Furthermore, supposing that depression and stress are constant, a 10-unit increase in anxiety leads to a 0.8-unit reduction in sleep quality. Assuming that depression and anxiety are constant, a 10-point increase in stress causes a 3-unit reduction in sleep quality.



**Fig. 2** A model with standardized coefficients.

## Discussion

The present study aimed to examine a model of the relationship between constipation and sleep quality mediated by stress, anxiety, and depression. The path analysis method was used to test the model. An important advantage of path analysis is the possibility of calculating the direct and indirect effects of variables on each other, thus detecting the most effective variable using the total effect. The path analysis determines the extent to which each independent variable has a direct and indirect effect on the dependent variable. In the present study, the results of testing the model indicated that the model fitted well. Hence, the research hypotheses were confirmed. It was also revealed that constipation, stress, anxiety, and depression constructs were significantly related to sleep quality as constipation had a positive and significant effect on sleep quality. It had also an indirect effect on the sleep quality in the elderly by affecting stress, anxiety, and depression. The proposed model providing a summary of the research background can be used in future research to help manage sleep quality in old people. The path analysis results also indicated that the fitted model could explain 60% of the sleep quality variance. Therefore, to enhance the sleep quality in the elderly, it is necessary to pay attention to constipation, stress, anxiety, and depression, and perform appropriate interventions to improve them. Other demographic and physical variables, such as drug use, were the reason for not explaining sleep quality (dependent variable) completely by the independent variables of the model (constipation, stress, anxiety, and depression), which were not considered in the model.

In the present study, constipation had a positive and significant effect on the reduction of sleep quality in the elderly. In other words, the more severe the constipation, the lower the sleep quality. The results of a study by Sanete et al. indicated that the elderly with constipation had less physical activity and more sleep problems than other elderly with normal bowel movements. There was also a relationship between sleep and constipation in the sick elderly.<sup>18</sup> The results were consistent with those of our study.

Our study indicated that increasing constipation would simultaneously increase depression, anxiety, and stress. In Alimoradzadeh's study, the prevalence of depression was higher in people with constipation than in healthy individuals, which was consistent with our study.<sup>31</sup>

The present study deeply considered the mediating roles of depression, anxiety, and stress. It also indicated a statistically significant relationship between the mediators and reduction of sleep quality. The findings of the present study were consistent with the findings of a study by Abbasi et al. (2018). They found that depression was the main determinant of sleep disorder.<sup>32</sup> Junhong Yu also indicated that depression and anxiety were linked to several sleep-related issues in the elderly.<sup>33</sup>

The prevalence of sleep disorders in our study was 45%. In another study, the prevalence of sleep disorders was reported to be between 35 and 45%,<sup>20</sup> which was consistent with the results of our study. In the study by Papi et al., 86.1%

of the elderly had sleep disorders,<sup>4</sup> which was inconsistent with the results of our study; however, that could be due to differences in participants because their study focused on sleep disorders in elderly living in a nursing home.

The findings of the present study showed that 18.9% of the elderly have depressive disorder. In different studies, its prevalence in the elderly has been reported to be from 25 to 50%.<sup>23,24</sup> In the study by Arslantas, in Turkey, the prevalence of depressive disorder in the studied elderly was 45.8%.<sup>34</sup> This difference can be due to ethnic and regional differences and data collection tools.

The findings also showed that the prevalence of anxiety was 22%. In a study of the elderly living in a nursing home, the rate of moderate and severe anxiety was 34.5%. Most of our study reported that this difference could be due to differences in the living environment of the elderly.<sup>23</sup> In a study by Alessandra Canuto et al. in five European countries and in Israel examining the prevalence of anxiety disorders in older men and women, the prevalence of anxiety disorders was 17.2%,<sup>35</sup> which was close to the one found in our study.

The prevalence of constipation in the elderly participating in the study was 17.8%. In a study on premenopausal women, 35.4% were diagnosed with constipation.<sup>36</sup> The difference in the prevalence of constipation between these two studies may be due to the difference in the participants because in the latter study, research had been done on premenopausal women and, as mentioned, women experience constipation more than other people in the community.

Regarding the limitations of the present work, since data were collected by questionnaires, there was a possibility of bias in answers, which should be interpreted with caution. As the study was correlational and predictive, it was not possible to draw definitively causal conclusions. To prove its findings, we propose to perform field studies on a larger scale and control some factors. The present study did not control whether some variables, such as age and gender, affected the relationship between the studied variables. Thus, future studies are suggested to consider these variables.

## Conclusion

According to the proposed model, constipation could significantly predict sleep quality due to the mediation of stress, anxiety, and depression. The knowledge about determinants of sleep quality in the elderly helps to take measures to increase or decrease their effects. The constructs of this model (constipation, stress, anxiety, and depression) can be used as a reference framework to design effective interventions to improve the sleep quality of the elderly.

### Conflict of Interests

The authors state that there are no conflicts of interest in this research.

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