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The Effect of Sleep Quality on the Life of Young People

Mofei Tian

College of Biological and Food Engineering, Heifei Normal University, Hefei, China
2211430077@stu.hfun.edu.cn

Abstract: Today's sleep problems are a very widespread factor that cannot be ignored and affects the quality of life. In this paper, the Multiple Linear Regression is an important method that the paper used. The influence of some factors on sleep was analyzed. Finally, it was screened out: stress level factors, heart rate levels, and physical activity levels have a great impact on sleep quality. The overall performance of the model was very good, R2=0.848, 84.8% of the changes in sleep quality could be explained by these variables, F-value = 5.11.401, p=0.000, the model was very significant. This paper also has shortcomings. The sample size selected in terms of data selection is relatively small, and the selection of analysis methods is relatively shallow. This dataset is not thoroughly analyzed because it is not first-hand data, making it difficult to isolate the effect of a single variable on sleep quality. In the future, this paper will conduct a longitudinal study to track the changes of the same factor over time. For example, ask inactive people to self-assess their sleep quality. Then, have them exercise every day to track the quality of their sleep. Summarize the changes in their sleep quality after one month.

Keywords: Sleep quality, stress, physical activity.

1. Introduction

Sleep plays a crucial role in maintaining overall health and cognitive function. Quality sleep can help improve performance and well-being, while lack of sleep and poor quality sleep are global health problems and have significant health risks [1]. College students, in particular, often experience inadequate sleep due to factors such as academic pressure, poor sleep environments, and irregular routines. The research results show that only 61.066% of Students born after 2000 have normal sleep, the rest 31.823% are in mild insomnia, 6.624% are in moderate insomnia, and 0.485% are in high insomnia [2]. Therefore, it is very important to study the quality of sleep.

Studies have shown that there is a clear association between poor sleep and low academic performance. Sleep disruption can seriously affect learning ability, which in turn harms students' academic performance. When people have shallow sleep, frequent dreams, or wake up frequently at night, they may make up for it by taking a nap during the day. However, studies have found that sleep quality can better reflect a person's health and functional status than sleep duration [3, 4].

In order to explore the association between sleep quality and the academic performance of college students, multiple linear regression (MLR) was used to integrate the related studies. However, improving sleep quality offers numerous benefits beyond academic performance, positively affecting both physical and mental health. Given the significance of sleep, this study aims to examine the key factors influencing sleep quality among college students and the broader implications of poor sleep.

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The study will employ an MLR to analyze the relationship between sleep quality and various influencing factors. Empower parents, educators, and policymakers to take smart steps to promote better sleep habits and overall health in youth.

2. Method

2.1. Data source

The data in the figure below comes from Kaggle, and the author is not marked for the time being. Titled: Sleep, Health and Lifestyle. Given the unsatisfactory analysis of the previous set of datasets, for the sake of rationality, this paper uses another set of datasets to analyze and adds new independent variables: stress level, heart rate, daily step count, and physical activity level. The total sample size was 374. Most of the interviewers of the data are doctors, teachers, sales representatives, nurses, software engineers, accountants, lawyers, etc. Ages range from 27 to 59, with a sex ratio of nearly 1:1.

2.2. The principle of the model

MLR analysis examines how a dependent variable changes with independent variables. It includes linear and logistic regression, helping to understand relationships and make predictions based on variable variations.

As a statistical analysis technique, MLR can be used to model a linear relationship between multiple explanatory variables and a single continuous dependent variable. By establishing a regression equation, it is possible to evaluate the independent effect of each independent variable on the dependent variable and predict the trend of change in the dependent variable.

2.3. Data analysis results

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\ldots+\beta_nX_n+\varepsilon \quad (1)$$

In this study, Y denotes the dependent variable. X usually represents an independent variable, which can be multiple, and n is the number of independent variables.

When all independent variables are 0, the constant term β_0 represents the predicted value of the dependent variable. $\beta_1, \beta_2 \ldots \beta_n$ is the regression coefficient and reflects the strength of the influence of the corresponding independent variable on the dependent variable, and the ε term is used to represent the error between the estimated and true values of the model.

2.3.1. Variable introduction

There are 374 pieces of data in total. The daily step count represents the number of steps taken by the respondent each day. A participant's daily level of physical activity is measured in minutes, which represents the total amount of time they are physically active each day.

Stress levels (scales: 1-10) are subjective assessments of a participant's stress levels on a scale of 1 to 10. A participant's resting heart rate is expressed in beats per minute (bpm) and is a measure of their heart's activity level at rest. Sleep quality is assessed by subjective ratings from 1 to 10.

2.3.2. The results are displayed

The results in Table 1 show that the coefficient of determination (R^2) is 0.848 and the adjusted R^2 is 0.846, indicating that the selected independent variables can explain about 84.6% of the variation in sleep quality and have strong explanatory power.

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In addition, the standard estimation error of the model is 0.469, indicating that the average deviation between the predicted value and the actual observed value is small, and the model fits well.

Further results in Table 2 show that the F value of the regression model is 511.401, and the significance level (p value) is less than 0.001, indicating that the overall model is statistically significant, that is, at least one independent variable has a significant effect on sleep quality. The regression sum of squares is 450.500, accounting for 84.8% of the total sum of squares, which further verifies the model's explanatory power. The residual sum of squares is 81.044, and the mean square error is 0.220, indicating that the residual of the model is small and the fitting effect is good.

In summary, factors such as physical activity level, stress level, heart rate, and daily step number significantly impact sleep quality. The established multivariate linear regression model is statistically significant, has a good fitting effect, and can effectively explain the variation in sleep quality.

Table 1: Model summary

model	R	R^2	After adjustment R^2	Errors in standard estimates
1	0.921[a]	0.848	0.846	0.469

a. Predictor: (constant), physical activity level, stress level, heart rate, daily steps

Table 2: ANOVA

model	Sum of squares	degree of freedom	mean square	F	Distinctiveness
regression	450.500	4	112.625	511.401	0.000[b]
Residuals	81.044	368	0.220		
total	531.544	372			

a. Dependent variable: quality of sleep

b. Predictor: (constant), physical activity level, stress level, heart rate, daily steps

3. Regression model analysis

The linear regression model showed a strong fit, as shown by the following key statistical metric: the model showed a strong relationship between independent variables and sleep quality.

Sleep quality mediated the association between chronic stressor exposure and depressive symptoms in the current study [5]. In short, a person is under chronic stress, which can affect the quality of their sleep, and the decrease in sleep quality can cause or aggravate the symptoms of depression. Sleep is a modifiable behavior, and its improvement may increase resilience and, in turn, reduce stress, according to recent research [6]. In other words, sleep and stress interact to create a virtuous cycle, with less stress and better sleep. The better you sleep, the more stress you can relieve. At the same time, daily physical activity has also been shown to help improve sleep quality.

Physical activity leads to better sleep or less frequent, and better sleep leads to greater participation in physical activity, which is also a positive feedback to each other [7]. Moderate exercise not only relieves stress but also promotes the balance of hormones in the body and improves the duration of deep sleep.

Accumulating evidence suggests that sleep-guided processes play an important role in promoting the regulation of endocrine functions involved in tissue regeneration and tissue remodeling [8]. At the same time, long-term exercise can also enhance cardiopulmonary function, improve blood circulation, and help maintain the heart rate in a more reasonable range, thus playing a benign role in regulating sleep.

It is important to note that although some important variables have been covered in this study, there may be some subjective bias due to the limited sample size and the fact that some data are self-

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reported. Therefore, future research can introduce more objective measurement methods, such as sleep and exercise data recorded by wearable devices, to further verify and enrich the existing conclusions and improve the accuracy and practical value of the model.

4. Conclusion

This model provides strong evidence that stress levels and heart rate hurt sleep quality, while physical activity levels have a positive effect. However, daily step count did not show a significant association. The high R^2 value and significant F-test statistic further confirmed that the model could effectively capture the key factors affecting sleep quality.

Therefore, people can reduce stress in their lives by being "alone", such as listening to music, reading, meditating, or taking short breaks from social activities, all of which can help with emotional regulation and mental relaxation.

Try to maintain a stable heart rate in life to avoid excessive changes in heart rate. Leave free time to exercise your body, do aerobic exercise, and improve your heart and lung health. These are all good for sleep quality.

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