# Circadian Code; Deciphering the Role of Blood Groups in Sleep Pattern

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## ABSTRACT

**OBJECTIVE:** To establish the relationship between blood groups and sleep, establish the interference that differences in blood groups have on circadian rhythms, and specifically establish and analyze sleep patterns among blood groups.

**METHODOLOGY:** A cross-sectional study was conducted in the Department of Physiology from March 2023 to June 2023, with a sample size of 381 male participants within the age range of 18–24 years. Blood grouping was performed, and a valid questionnaire (PSQI) was employed to determine the quality of sleep.

**RESULTS:** Among 381 participants, 118 (30.97%) were having good sleep and 263 (69.03%) were suffering from bad sleep. According to the PSQI questionnaire, 54 (14.17%), 114 (29.92%), 32 (8.39%), and 63 (16.53%) were in the in the A, B, AB, and O blood groups, respectively, and had bad sleep. Furthermore, 234 (61.41%) and 29 (7.61%) were in the in the Rh+ and Rh-blood groups, respectively, and had bad sleep. The highest frequency of bad sleep was found in B+ blood group 105 (27.55%).

**CONCLUSION:** Conclusively the highest frequency of bad sleep was found in blood group B and RH+.

**KEY FACTORS:** Blood Groups, Sleep Pattern, PSQI questionnaire, Circadian rhythm.

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## INTRODUCTION

Sleep is a state of unconsciousness from which a person can be aroused by different stimuli. It is a state of mind in which the central nervous system, especially the cerebral cortex, becomes less responsive to external and internal stimuli.[1] Sleep is an important physiological response that is necessary to maintain normal homeostasis. It is important for cognition stabilization, the growth of somatic tissues, and the release of different hormones.[2] Sleep duration is divided into two alternate phases: non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. Different physical activities, alcohol consumption, and tobacco use decrease the NREM sleep phase and increase the REM sleep phase, leading to frequent arousals and disturbed quality of sleep.[3]

The quality of sleep can be estimated by judging the duration of sleep, the number of wakeful arousals, the depth of sleep, and the feeling of satisfaction after arousal.[4] Good quality sleep is 7-9 hours' sleep that initiates easily and whose depth is satisfying. A sleep is referred to as disturbed if it does not meet those requirements. It is estimated that 29–38% of people throughout the world are suffering from difficulty sleeping, while this may increase to 70% for people doing stressful jobs and students.[5] The most important aspect of disturbed sleep is difficulty initiating sleep and frequent arousals during sleep. A disturbed sleep cycle usually leads to different complications, such as anxiety, depression, epilepsy, and different cardiovascular and central nervous system disorders.[6]

People who are engaged in working for longer durations and have a stressful lifestyle are more likely to suffer from insomnia and psychological disorders.[7] In today's world, internet addiction has contributed to disturbed sleep, which has led to social isolation and poor academic performance.[8]

In the 19th century, blood group antigens were initially discovered, and from there on, multiple studies were conducted to detect any link between different diseases and blood groups. A scientist by the name of Landsteiner formally defined blood types in 1941. Blood group matching has made significant contributions to blood transfusion and organ and tissue transplantation since that point in history.[10] Blood groups are classified by the presence of specific carbohydrate moieties

present on the surface of red blood cells and different epithelial cells throughout the body. Different diseases interact with these antigens to produce specific diseases in specific people.[11] The human body contains antigens specific to ABO blood types in a variety of locations, including red blood cells, platelets, the endothelium of arteries, and other body cells. Blood group antigens function as allergen receptors and are involved in hemostasis and cell membrane stabilization.[12]

There are 345 blood antigens and 43 blood types, according to the International Society of Blood Transfusion. In 1900, blood groupings were first identified. There are four blood types that are recognized globally: A, B, AB, and O. Their classification is based on the glycoprotein antigens that they contain. The Dell, Duffy, MNs, and Kidd blood groups are also included.[13] One blood group may be more resistant to some diseases than another due to the strength of its antigens.[14] Blood types, particularly the ABO system, are closely linked to a number of illnesses. It has been observed that, whereas non-O blood groups have cardiovascular illnesses, O blood groups are protected against pancreatic cancer. Allergy and bronchospasm are typically linked to blood types. An elevated eosinophil count in the serum serves as additional confirmation.[15,16] According to several studies, certain diseases are more common in one blood group than in another. For example, plasmodium falciparum is more common in the B group, and blood groups B are more likely to contract Falciparum infection.[17] Different researchers have investigated the link between blood groups and sleep quality. In a study, it was concluded that in females, A+ females sleep more, A- sleep less, B+ sleep more, and O- and A- negatives suffer from insomnia.[18]

The current study was conducted to investigate any link or association between certain blood groups and Sleep disorders.

The aim of the study was to compare sleep quality among ABO and/or Rhesus blood typing. This research evaluates the possible association of blood groups with sleep quality. The Chi-Square test was applied to study the relationship of sleep patterns among studied blood group units. Personalized sleep hygiene and management strategies may be one significant way the predisposition of each blood group to good or bad sleep may give way. Knowing this linkage will help for great approaches to improve overall health and well-being through personalized blood group characteristic features.

## METHODOLOGY

A (Survey based) cross sectional study was carried out from March 2023 to June 2023 (04 months). The data was collected through a random sampling method from different departments of University of Sindh Jamshoro, Sindh. The sample size of this study was 328 participants, and inclusion and exclusion criteria were made according to the research criteria of Hublin, C., Partinen, et al.., conducted in 2021. This study included only male participants within the age range of 18–60 years, and all participants were in clearly identified blood groups (A, B, O, and AB), and all participants had the ability and willingness to use sleep tracking devices for data collection. All females and all those participants were excluded from this study that had any systematic disease, including diabetes mellitus, chronic sleep disorders, or suffering from any psychological or mental disorder that affects the study results.

A valid and authentic questionnaire "The Pittsburgh Sleep Quality Index (PSQI)" was employed for quality and patterns of sleep in adults. It was made sure that all the participants were accommodated in a comfortable environment during the filling up of Performa. Each answer was given a number. The maximum score was considered significant for bad sleep. Rhesus and ABO blood grouping was performed by an antigen/antibody reaction (agglutination reaction) test using standard antisera A, antisera B, and antisera D (Rapid Labs UK). The blood grouping was repeated with the same sample to minimize the error and maximize the accuracy.

Statistical Analysis: Data are shown as proportions and percentages; n indicates the number of participants. The significant threshold was set at $P > 0.05$ and Confidence interval at 95% calculating fisher, s exact and chi square test. Odds ratio, likelihood ration, sensitivity and specificity were calculated. GraphPad Prism 5 was used to analyse data.

## RESULTS

A total of 381 males were recruited in the current study. The mean age was 17.35±1.18, with a standard deviation of 1.17 (16–19 years). The mean BMI of the participants was 18.85 ± 1.73, and the standard error of the mean was 0.29. The response rate of this study was 100%, as all participants consented to take blood samples and agreed to fill out the PSQI questionnaire. Table 1 shows that, among 381, 118 (30.97%) participants were having good sleep and 263 (69.03%). Participants were suffering from bad sleep. The B blood group was most common (29.92%) in having bad sleep. A chi-square test was applied. The P value was 0.25, showing no significance between bad sleep and any specific blood group.

Apparently, it appeared that the Rh+ blood group was mostly involved in having a bad sleep pattern (see table 2). However, Fischer exact test was applied which derived p value 0.22 showing non-significant association between sleep pattern and Rh type(odd ratio = 0.53, like hood ratio=0.96).

The association of bad sleep with positive and negative blood groups. Most of the common blood group for having bad sleep

was B+ but it was not statistically significant (p value=0.87, df= 14, x2 =8.2).

| Blood group | Good Sleep | Bad Sleep | Total | $X^2$ | *p*-value |
|---|---|---|---|---|---|
| A | 29(7.61%) | 54(14.17%) | 83(21.78%) | | |
| B | 46(12.07%) | 114(29.92%) | 160(42.00%) | | |
| AB | 22(5.77%) | 32(8.39%) | 54(14.17%) | 4.027 | 0.25 |
| O | 21(5.51%) | 63(16.53%) | 84(22.04%) | | |
| Total | 118(30.97%) | 263(69.03%) | 381(100%) | | |

Table 1: Comparison of Sleep Quality Among Different Blood Groups Using Chi-Square Test.

| Blood typing | Good sleep | Bad sleep | Total | X2 | df | *p*-value |
|---|---|---|---|---|---|---|
| $A^+$ | 25(6.56%) | 47(12.33%) | 72(18.89%) | | | |
| $A^-$ | 04(1.04%) | 07(1.83%) | 11(2.88%) | | | |
| $B^+$ | 41(10.76%) | 105(27.55%) | 146(38.32%) | | | |
| $B^-$ | 05(1.31%) | 09(2.36%) | 14(3.67%) | | | |
| $AB^+$ | 17(4.46%) | 27(7.08%) | 44(11.54%) | 8.230 | 14 | 0.877 |
| $AB^-$ | 05(1.31%) | 05(1.31%) | 10(2.62%) | | | |
| $O^+$ | 21(5.51%) | 55(14.43%) | 76(19.94%) | | | |
| $O^-$ | 00(00.00%) | 08(2.09%) | 08(2.09%) | | | |
| Total | 118(56.67%) | 263(43.33%) | 381(100%) | | | |

Table 3: The proportion of ABO and Rh blood types in good sleep versus bad sleep in male students.

| Blood group | Good Sleep | Bad Sleep | Total | *p*-value | *Odds ratio* | *Likelihood ratio* | *Sensitivity & Specificity* |
|---|---|---|---|---|---|---|---|
| Rh(+) | 104(27.29%) | 234(61.41%) | 338(88.71%) | .22 | 0.53 | 0.96 | 0.91 & 0.04 |
| Rh(-) | 14(3.67%) | 29(7.61%) | 43(11.29%) | | | | |
| Total | 118(30.97%) | 263(69.03%) | 381(100%) | | | | |

Table 3: The proportion of ABO and Rh blood types in good sleep versus bad sleep in male students

will delve into the emerging findings and explore the potential links between blood groups and sleep patterns.

The study concluded that, according to the PSQI questionnaire, 54 (14.17%), 114 (29.92%), 32 (8.39%), and 63 (16.53%) were in the A, B, AB, and O blood groups and had bad sleep. Furthermore, 234 (61.41%) and 29 (7.61%) were in the Rh+ and Rh-blood groups, respectively, and had bad sleep. The highest frequency of bad sleep was found in B+ (ABO and Rhesus combined) at 105 (27.55%). Conclusively, the highest frequency of bad sleep was found in blood groups B and Rh+.

These results concur with the study results of other researchers. The study conducted by Smith J. et al.. in 2021 showed that the prevalence of poor quality of sleep is higher in participants with blood group B, with odds ratios of 2.5 and CIs of 1.7–3.6.[18] Jonshon P et al.. (2021) also reported that individuals with Rh positives are at a higher risk of sleep disturbance, which is further supported by statistical results of odds ratios (CI: 1:51.5–3.1).[19] Lee Hy et al.. (2022) demonstrated that individuals with blood group B+ had a higher incidence of sleep disorders, with an odds ratio of 3.0 (95% CI: 2.0–4.5).[20] But there is another group of researchers who do not find any significant association between these two entities. Brown M. et al.. (2021) found no significant association between sleep quality and blood groups, which was statistically supported by an odds ratio of 1.1 (95% CI: 0.7–1.8), suggesting that blood group is not a predictor of the sleep quality of an individual.[21] Harris et al.. (2022) also concluded that blood groups had no predictive value for sleep quality and suggested that other variables may be more important than blood groups.[22] Kim HJ. Etal in 2021 also reported that there is no significant correlation between blood groups and sleep disorders with an odd ratio of 1.0 (95% CI: 0.7–1.6).[23]

In conclusion, the relationship between blood groups and sleep

## DISCUSSION

Sleep patterns play a crucial role in maintaining overall health and well-being. Recent research has sparked interest in understanding whether there is a correlation between an individual's blood group and their sleep habits. This discussion

patterns is an intriguing area of research that warrants further investigation. The findings from recent studies suggest potential connections that may have implications for understanding sleep regulation, addressing sleep disorders, and tailoring sleep interventions to individual needs.

**Recommendation:** It is recommended that further research is

necessary with different demographic factors to establish any link between blood groups and sleep disorders

## CONCLUSION

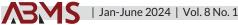Conclusively the highest frequency of bad sleep was found in blood group B and Rh+.

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**AUTHORS CONTRIBUTIONS**

**NN:** Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable.

**SFU:** Conception, Design of the work, Acquistion, Data Analysis, and Drafting, Reviewed, Final approval, Agreement to be accountable.

**SA:** Conception, Design of the work, Interpretation of data for the work, and Drafting, Reviewed, Final approval, Agreement to be accountable.

**JW:** Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable .