Investigating the impact of Alpha Binaural waves on sleep quality and daily performance of teachers aged 40 to 50 in the metropolis of Rasht

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ABSTRACT

Sleep is one of the most important need of humans. Approximately one-third of each person's life is spent sleeping. Otherwise, the quality of sleep is a variable that plays very significant role in human health. Therefore, attention must always be paid to the effects of various environmental factors, including the role of waves and music, on sleep quality. The aim of this research was to examine the effect of alpha binaural waves on the sleep quality of teachers aged 40 to 50 in Rasht. For this purpose, in the initial stages of the project, a designed consent form along with the initial PSQI form was completed by a sample population of 18 individuals of both genders to assess their initial sleep quality. Based on the scores, the target population was divided into four groups. One group was given instrumental piano music as a control, while the other three groups were exposed to binaural alpha waves at frequencies of 8, 10, and 11 hertz. Then, over a 30-day period, daily forms were designed to monitor the daily performance and quality and quantity of sleep of the sample individuals after listening to the binaural waves before bedtime. These forms were completed by the sample population and evaluated daily by the team members. At the end of the 30-day period, the final PSQI form was designed to assess the sleep quality and daily performance of the study participants and was completed by them. The scores were calculated and analyzed using Microsoft Excel 2022.

Keywords: alpha, Binaural waves, middle-aged individuals, PSQI, sleep quality

1. INTRODUCTION

Sleep is one of the physiological and essential needs of humans and is a regular, repetitive, and reversible state [1]. Sleep is important for maintaining physical and cognitive functions in daily life [2]. It is also recognized as a significant factor in the quality of life and health [3]. On the other hand, many people do not experience quality sleep due to their mental, occupational, and family concerns, underlying health conditions, and medication use. So far, various strategies have been implemented to improve sleep quality, one of which is listening to music. Binaural Beats are a perceptual-auditory illusion resulting from hearing two waves with frequencies that are close but different from each other simultaneously through both ears [2]. These waves are heard in five states: alpha, beta, gamma, theta, and delta, based on different frequencies. Each has different effects according to its frequency, which can generally be summarized as increasing relaxation, creating a good feeling, and reducing anxiety. In this research project, the effect of alpha binaural waves on specific sleep quality parameters has been studied among teachers in the city of Rasht aged 40 to 50 years.

2. RESEARCH METHODS

To carry out this project, initially, after obtaining consent from the volunteer participants, the initial PSQI form was given to them from August 7 to 10 to assess their sleep scores and quality. Subsequently, the participants were divided into four groups, with the first group serving as the control group receiving instrumental piano

music, while the other three groups were exposed to binaural alpha waves at frequencies of 8, 10, and 11 hertz, respectively. It is noteworthy that the study population was unaware of the music being used in this project. On August 15, the assessments were conducted for a duration of 30 days, until September 15. Each night, participants listened to the assigned music for 15 to 20 minutes before sleep, and starting from the second night (August 16), they were required to answer questions on a daily form designed uniformly for all. This form collected information such as sleep hours, caffeine consumption or lack thereof, afternoon naps, daily energy levels, and activities that affected sleep and energy. To ensure accurate monitoring of the participants and to confirm proper adherence to the tasks, the study population was divided among team members, and their activities were reviewed each night by team members, who provided necessary reminders to the volunteers. Then, on the thirtieth day, the final PSQI form was given to the participants to assess changes in their scores.

For statistical data analysis and conducting the t-test, Microsoft Excel 2022 was used. The initial PSQI scores of each group were summed, and the mean was calculated, and the same process was applied to the final PSQI scores. Then, using the initial and final mean scores, an f-test was conducted in Excel, and based on the results obtained, the corresponding t-test was used to determine the presence or absence of significant differences in the mean initial and final scores within each group.

In this research project, while adhering to all ethical principles and rules, and to ensure the consent of all individuals in the statistical community participating in this plan, consent forms have been obtained from them. Additionally, all information received from the target statistical community has been personalized and will not be disclosed in any way. The physical and mental well-being of the participants in this project is guaranteed, and to ensure their consent regarding any changes in the research process, obtaining consent forms again has been considered. Given that these individuals all had busy work schedules, they willingly accepted to participate in this project to improve sleep quality and committed to answering the questionnaires provided to them honestly until the end of the research.

This project has been conducted on a statistical population of teachers aged 40 to 50 in the city of Rasht, and until now, no similar project has been carried out on this age group. Similar projects in the field of binaural alpha waves have so far focused on student populations; however, this project has been implemented on individuals with high work and mental engagement. It can be said that this is the first time such work has been done using binaural alpha waves with specific objectives and on a different age range. Other research related to binaural alpha waves has mostly focused on reducing stress in individuals, but this project concentrates on the quality of sleep and the level of efficiency and energy of individuals throughout the day.

3. RESULTS AND FINDINGS

In this project, the mean initial and final scores of the PSQI form in each group were examined to investigate the presence or absence of significant differences using the t-test in Microsoft Excel 2022.

Table 1 . t-test related to the 8 Hz binaural alpha group

t-Test: Two-Sample Assuming Equal Variances M8		
	Variable 1	*Variable 2*
Mean	9.4	8.4
Variance	25.3	9.3
Observations	5	5
t-Test: Two-Sample Assuming Equa	17.3	
Hypothesized Mean Difference	0	
df	8	
t Stat	0.380142961	
P(T<=t) one-tail	0.356866653	
t Critical one-tail	1.859548038	
P(T<=t) two-tail	0.713733307	
t Critical two-tail	2.306004135	

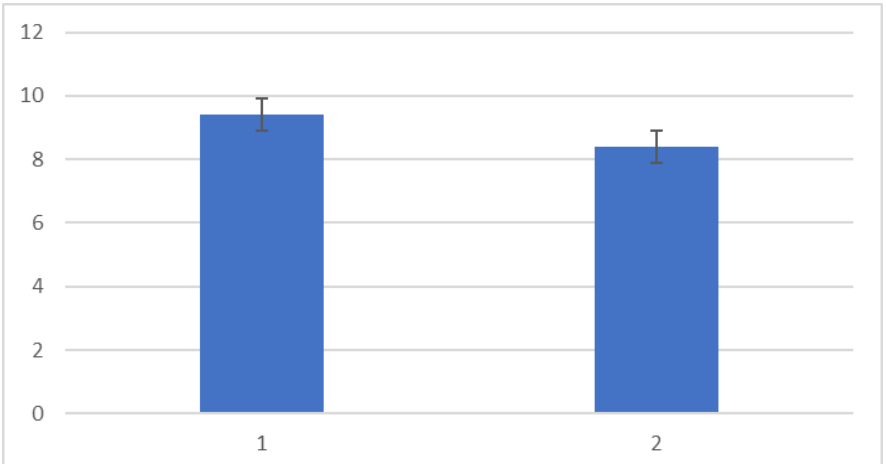


Figure 1 . Average scores of the 8 Hertz group along with standard deviation

Table 2. t-test related to the 10 Hz binaural alpha group

t-Test: Two-Sample Assuming Unequal Variances M10		
	Variable 1	*Variable 2*
Mean	6.6	4.2
Variance	3.3	10.7
Observations	5	5
Hypothesized Mean Difference	0	
df	6	
t Stat	1.434274331	
P(T<=t) one-tail	0.100745076	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.201490153	
t Critical two-tail	2.446911851	

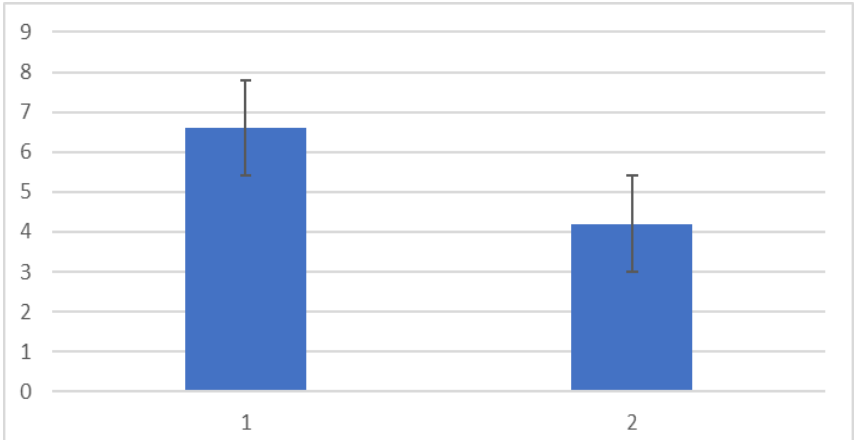


Figure 2 . Average scores of the 10 Hertz group along with standard deviation

Table 3. t-test related to the 11 Hz binaural alpha group

t-Test: Two-Sample Assuming Unequal Variances M11		
	Variable 1	*Variable 2*
Mean	7.25	5
Variance	13.58333333	2.666666667
Observations	4	4
Hypothesized Mean Difference	0	
df	4	
t Stat	1.116312611	
P(T<=t) one-tail	0.163409501	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.326819003	
t Critical two-tail	2.776445105	

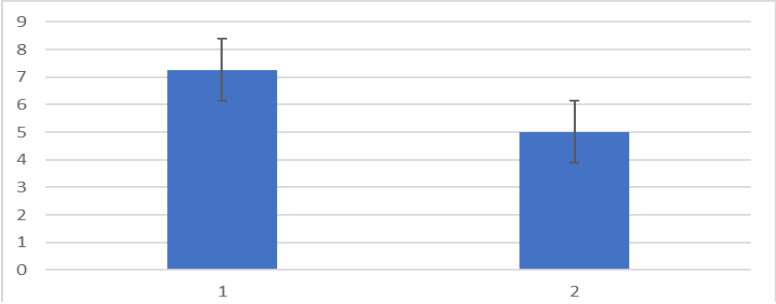


Figure 3. Average scores of the 11 Hertz group along with standard deviation

Table 4 - t-test related to the control group

t-Test: Two-Sample Assuming Unequal Variances VIP		
	Variable 1	*Variable 2*
Mean	4	2.5
Variance	0.666666667	3.666666667
Observations	4	4
Hypothesized Mean Difference	0	
df	4	
t Stat	1.441153384	
P(T<=t) one-tail	0.111491479	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.222982958	
t Critical two-tail	2.776445105	

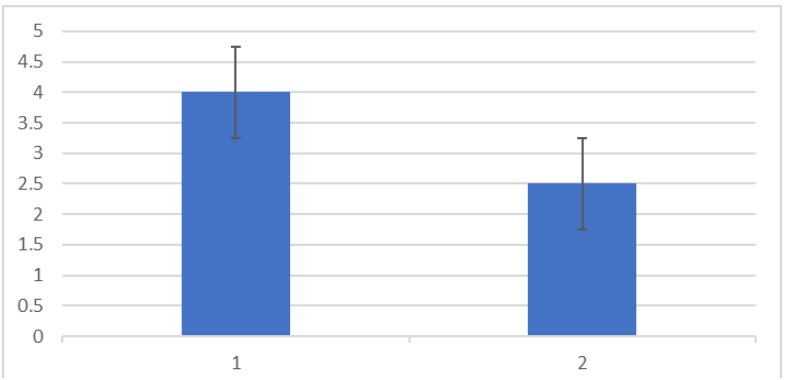


Figure 4 . Average scores of control group along with standard deviation

4. RESEARCH AND CONCLUSION

The comparison of t stat and t critical in the final table indicates that there is no significant difference between the mean scores of individuals in the initial and secondary forms at a 0.05 error level. However, an individual assessment of the scores revealed that these waves had a positive effect on some individuals, a negative effect on others, and were neutral in some cases. Ultimately, these waves did not have a significant impact on the quality of sleep of individuals. This suggests that lifestyle rhythms, jobs, and mental preoccupations have a considerable effect on sleep and the efficiency of individuals, and can influence sleep through various factors. A similar study conducted in this area by Shalfroshan and Bagherzadeh showed that binaural waves had a positive effect on the sleep quality of the student youth population, which presents a different outcome from the current project [4] . One possible reason for this discrepancy relates to the differences in the levels of emotions and preoccupations of individuals at various stages of life. Adolescents and young adults are at a high level of emotional engagement and, due to fewer mental disturbances, are more easily influenced by various stimuli; unlike adults who have significantly more mental burdens and whose emotional states are not at the same level as adolescents. Therefore, the impact of music on them may generally be less; however, this issue can lead to positive, negative, or neutral effects on an individual basis within any specific population.

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