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Influence of circadian rhythm on individual differences in morningness-eveningness scale among normal healthy subjects

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ABSTRACT

The circadian rhythm is a biological rhythm that produces physical, psychological and behavioural changes in a living organism, and it follows a daily cycle. This cycle depends on the response of the organism to light and darkness in the environment. The aim of the study was to analyse and evaluate the influence of circadian rhythm on individual differences in morningness-eveningness attitude among the normal healthy subjects. Morningness eveningness questionnaire is a standard tool to assess sleep, wakefulness alertness, self-awareness and best time activity of the individual either in the morning time or evening time. This questionnaire was self-administered, and it consisted of 10 questions and was circulated via google forms. The results revealed that a majority of 85% of the participants are evening types of persons and the significance level was a p-value < 0.05 of the chi-square test. The present study assessed the influence of the circadian rhythm on the morningness-eveningness scale, and results revealed that most of the participants were alarm dependant, had difficulty in waking up. They were very active in the evening and went to bed very late. So, the study concluded that the majority of participants were evening type of person.

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INTRODUCTION

Circadian rhythm or system is the natural internal process that regulates the sleep-wake pattern. The main cue influencing the circadian system is the daylight. Neutral factors within mammals, headed by the suprachiasmatic nucleus of the hypothalamus (Farhud and Aryan, 2018). Many of the findings have led to the budding field of chronotherapy, in which the doctors time medicine to the natural body rhythm (Fuller *et al.*, 2006). There are a variety of predisposing factors consisting like geographical events, lifestyle changes and biological molecules in the organism that have an impact on the circadian rhythms (Dijk and Archer, 2009).

The uncertain sleep-wake timing and disruption of the circadian rhythm, having unregulated schedules have led to increasing the incidence of chronic diseases. Circadian rhythm can affect the bodily functions like body temperature, sleep-wake cycle, blood counts, eating habits and digestion, hormone release etc. according to the previous research articles, the research done by Someren *et al.* (1997), the study was done by assessing the circadian system, and the temperature of the body and the results were observed. The morningness-eveningness scale is used to measure the preferred timing of rising and bedtime as well as physical and mental perfor-

mance and alertness after rising and after different activities. According to the studies done and other researchers done, the influence of the circadian rhythm on even the sleep patterns and many other factors such as the daily routines were examined and observed (Davis and Lentz, 1989; Devi and Sethu, 2018).

Some of the researches have been done on the immunity level as well, and the blood levels were examined and observed (Doljansky et al., 2005; Potter et al., 2016). This present research is necessary to find out or study how the circadian rhythm or the system can affect or have an influence on the morningness and eveningness scale among the normal healthy subjects.

The focus of the study was to investigate the influence of the circadian rhythm on individual differences in morningness-eveningness attitude among the normal healthy subjects.

MATERIALS AND METHODS

The type of population involved was a healthy male population. The questionnaire was based on a cross-sectional study. A standardised tool called morningness and eveningness scale was used to assess the best time for a person to sleep, wake up, do exercise, learn and do other activities. The number of people involved is 100. The sampling method used is the random sampling method. The study setting and study design are the observational studies within the study design. The exclusion criteria are smoking, taking of prescription medicine. The questionnaire consisted of 10 questions. The type of questions was open-ended and closed-ended questions.

The data collection software used was an online survey, google forms. The statistical analysis was done with the help of SPSS software version 22, and the values were represented as cumulative frequency and percentage. The statistical test used was the chi-square test, and the level of significance was fixed at p<0.001. Method of representation of the data was graphical representation, pie chart and bar graph. The independent variables are educational qualification, geographical location. The dependent variables are age and gender.

RESULTS AND DISCUSSION

The results of the morningness-eveningness scale showed the following responses when the participants were asked about their dependence on the alarm after having woken up in the morning, the responses were, (Figure 1), 52% are slightly alarm dependent, 24% not at all dependent and 24% are

very dependent. 24% of the participants replied that they were not at all dependent, 52% of the participants replied that they are slightly dependent. The remaining 24% of the participants replied that they are very dependent on the alarm. (p-value is 0.037) (Figure 2). However, this is statistically not significant(Pearson Chi -Square Value - 0.037). There was a similar finding by Morgenthaler et al. (2007). In the study, the participants depended more on the alarm for their morning routine, 72%. There are no previous articles with opposing findings. When the participants were asked how alert they feel after being woken in the morning, (Figure 3), 44% not at all alert; 30% slightly alert; 26% very alert, the responses were, 44% of the participants replied that they are not at all alert, 30% of the participants replied that they are slightly alert and 26% of the participants replied that they feel very alert. (p-value is 0.000) (Figure 4). There was a similar finding done (Thun et al., 2015), where the participants' responses were 55% were alert regarding the subject. There are no previous articles with opposing findings. There is a significant increase in total count of responses in age groups below 20 years statistically significant (PearsonChi -Square Value - 0.000)
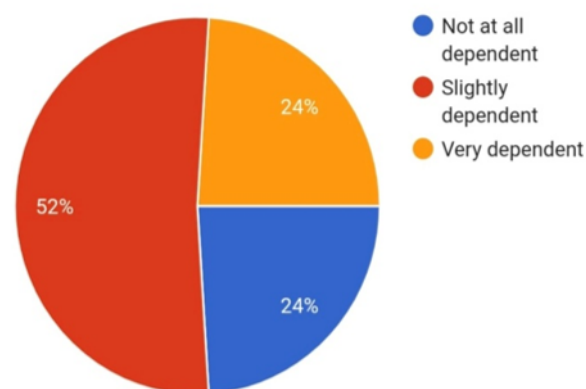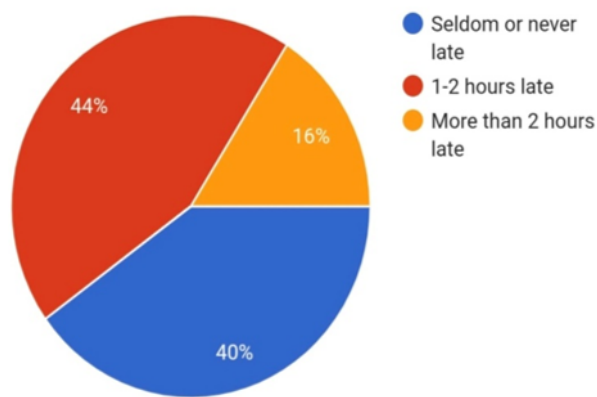

Figure 1: Pie chart depicting response to "If there is a specific time at which you have to get up in the morning, to what extent are you dependent on an alarm?"

When the participants were asked about their timing of going to bed without any commitments the next day, (Figure 5), 44% sleep 1-2 hours late; 40% as seldom late; 16% sleep more than 2 hours late, the responses were, 40% of the participants replied that they go to bed seldom or never late, 44% of the participants replied that they go to bed 1-2 hours late and 16% of the participants replied that they go to bed more than 2 hours or late. (p-value is 0.042)(Figure 6). However, this is statistically insignificant. (Pearson Chi -Square Value - 0.042). There are no previous articles with opposing find-
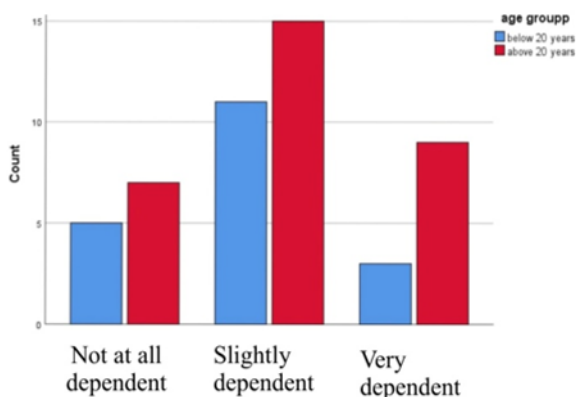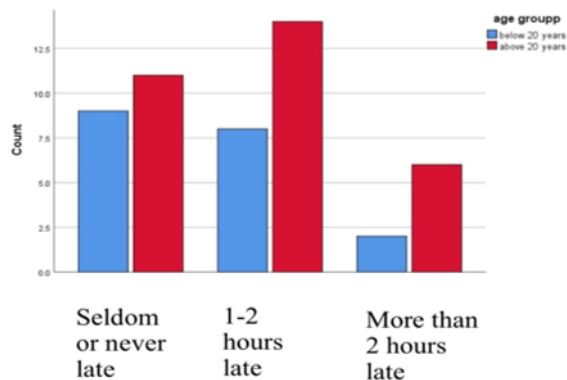
Figure 2: Bar graph depicting the association between age groups and the total count of responses
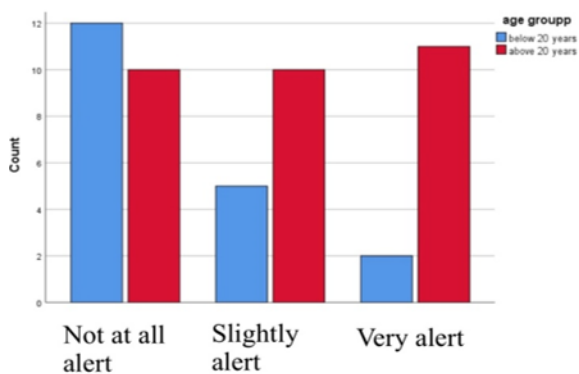
Figure 5: Pie chart depicting responses to "When you have no commitments the next day, at what time do you go to bed?"
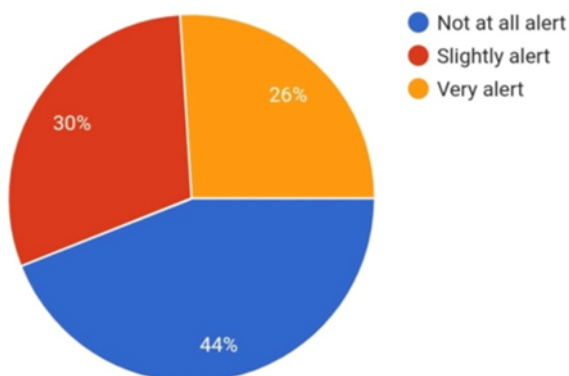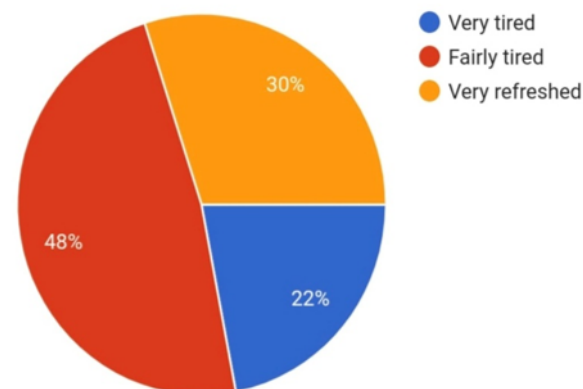
Figure 3: Pie chart depicting response to "How alert do you feel during the first half an hour having woken in the morning?"

Figure 6: Bar graph depicting the association between age groups and the total count of responses

Figure 4: Bar graph depicting the association between age groups and the total count of responses

Figure 7: Pie chart showing the responses to the question, "If you went to bed at 11pm, at what level of tiredness would you be?"
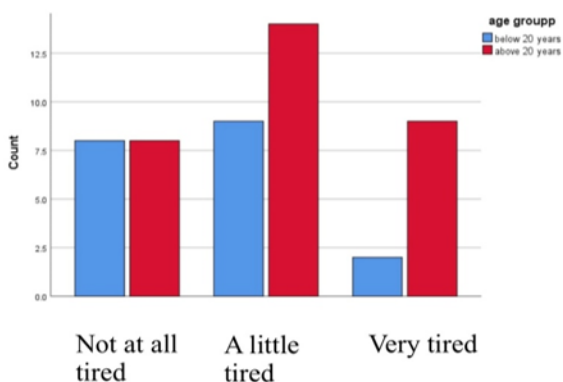
Figure 8: Bar graph depicting the association between age groups and the total count of responses
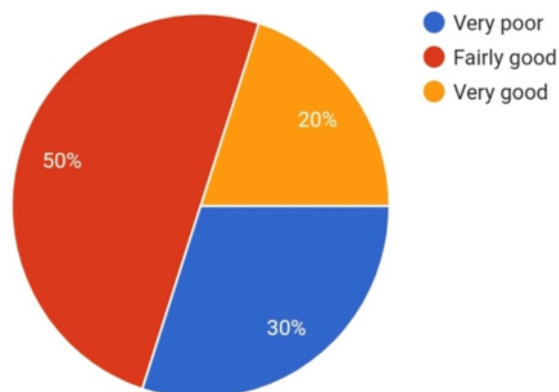

Figure 11: Pie chart showing the responses to the question, "How is your appetite during the first half an hour woken in the morning?"
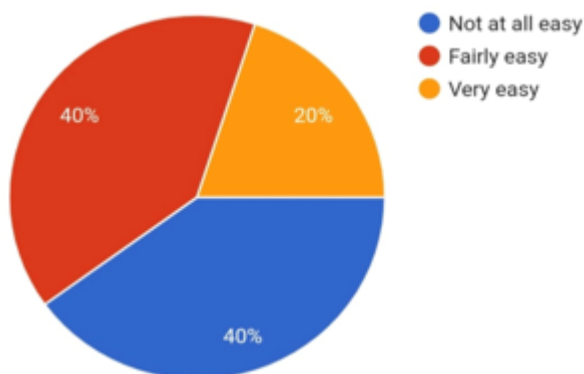

Figure 9: Piechart showing the responses to the question, How easy do you find getting up in the morning?" 40% fairly easy to get up in the morning
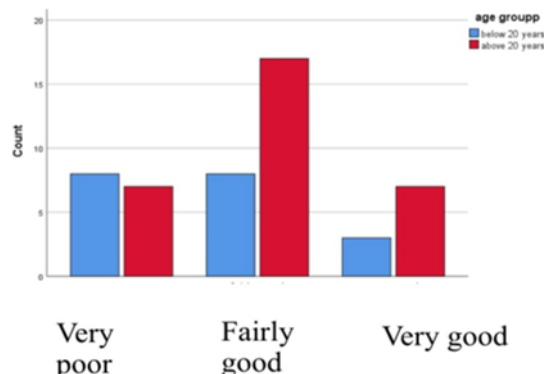

Figure 12: Bar graph depicting the association between age groups and the total count of responses

Figure 10: Bar graph depicting the association between age groups and the total count of responses

Figure 13: Pie chart showing the responses to the question, "During the first halfan hour having woken in the morning, how tired do you feel? "

Figure 14: Bar graph depicting the association between age groups and the total count of responses

Figure 15: Pie chart showing the responses to the question, "At what time of the day do you think that you reach your "feeling best" peak? " 40% feeling peaks in the Noon; Night (40%); 20% morning
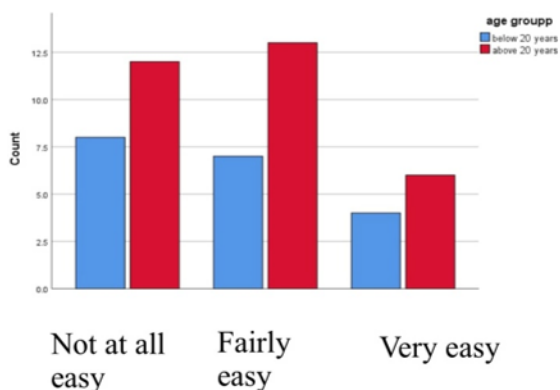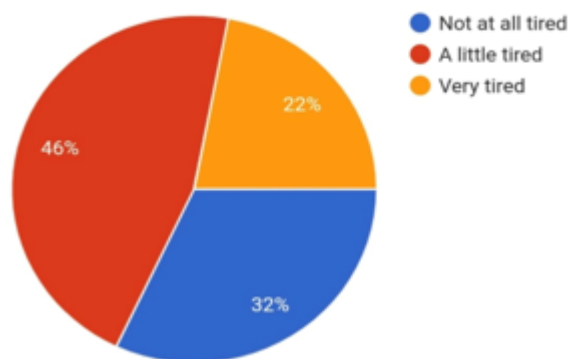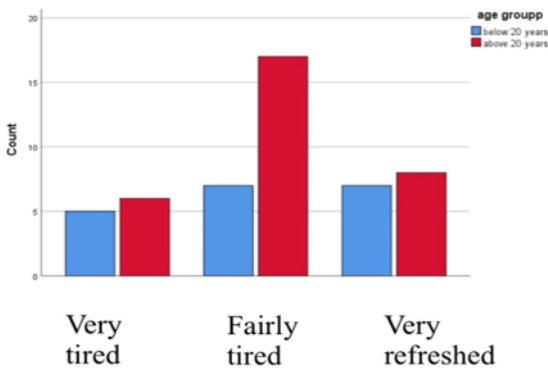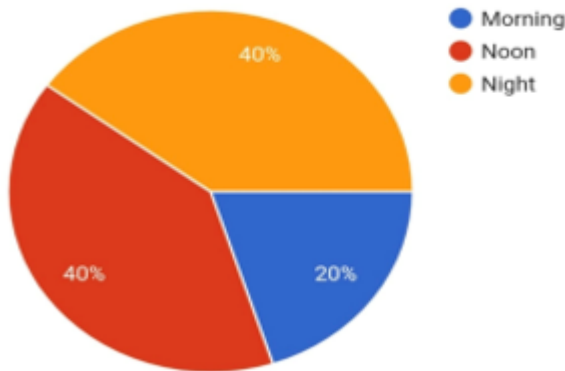

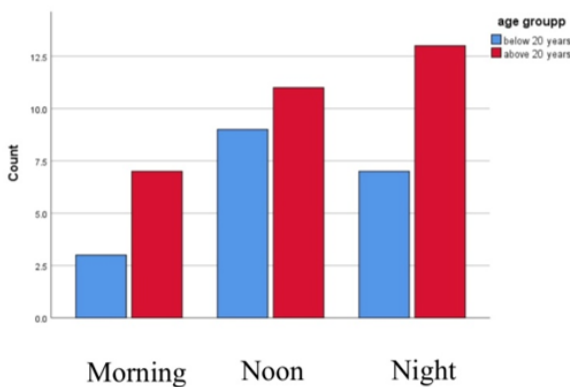**Figure 16: Bar graph depicting the association between age groups and the total count of responses**

ings. When the participants were asked about their level of tiredness at 11 pm, (Figure 7), Very tired to get up in the morning(48%); 30% of the very refreshed; 22 % very tired, the responses were, 32% of the participants replied that they are not at all tired, 46% of the participants replied they felt a little tired and 22% of the participants replied that they felt very tired. (p-value =0.000)(Figure 8). There is a significant increase in total count of responses in age groups above 20yrs, statistically significant (Pearson Chi -Square Value - 0.000). A similar study was conducted by Aarthy (Tähkämö *et al.*, 2019; Timothy *et al.*, 2019), where the study concluded the similar result with the percentage result as 82%. When the participants were asked about their level of easiness in getting up early morning, (Figure 9), 40% not at all easy to get up in the morning; 20 % very easy to get up in the morning. The responses were, 40% of the participants replied that it was not at all easy, 40% of the participants replied that it was fairly easy and 20% of the participants replied that it was very easy. (p-value is 0.028) (Figure 10). There are no previous articles with opposing findings. This is statistically insignificant. (Pearson Chi -Square Value =0.028).

When the participants were asked about their appetite during the first half an hour having woken in the morning, (Figure 11), the responses were, 30% of the participants replied as very poor, 50% of the participants replied as fairly good, and 20% of the participants replied as very good. 50% fairly good appetite;30%very poor appetite; 20 % of very good appetite, The appetite of the participants was fairly good during the first half an hour of the morning. (p-value is 0.000)(Figure 12). However, this is statistically significant and there is a significant increase in total count of responses in age groups above 20years (Pearson Chi -Square Value - 0.000) ,There was a similar finding done (Oldham *et al.*, 2016), where the responses recorded was that 58% of them had a strong appetite during the normal morning routine. There are no previous articles with opposing findings. When the participants were asked about their level of tiredness in the early morning (Figure 13). 46% were a little tired; 32% a little tired; 22 % very tired.

The responses were, 22% of the participants felt very tired, 48% of the participants felt fairly tired, and 30% of the participants felt very refreshed. (p-value is 0.000) (Figure 14). This is statistically significant and there is a significant increase in total count of responses in age groups above 20 years (Pearson Chi -Square Value - 0.000).

There are no previous articles with opposing find-

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ings. When the participants were asked about their feeling the best peak, (Figure 15), the responses were, 20% of the participants replied as the morning, 40% of the participants replied as noon, and 40% of the participants replied as night.

(p-value is 0.027)(Figure 16). There was a similar study done (Abigail *et al.*, 2019), where a similar finding was given about 52.3% responded as night. However, this is statistically insignificant.(Pearson Chi -Square Value - 0.027)

The circadian rhythm is a biological rhythm that produces physical, psychological and behavioural changes in a living organism, and it follows a daily cycle. This cycle depends on the response of the organism to light and darkness in the environment. Usually, when there is a consideration of the circadian rhythm, there are 3 types of people with whom this function of the circadian rhythm can be checked, they are the morning person, evening person or the night person. And according to the present study, the maximum percentage has been the evening person according to the results which have been evaluated. Since most of the participants are of the evening type, the expenditure of energy would be very high in the evenings, and even when the BMI is checked, the rate of BMI would also be very high. Now, many people are of the evening type. Their basic routine is being disturbed due to which they always lack sleep, or they become sleep-deprived, and they would always be having a greater social jet lag.

When it is observed, even the meal timings of those types of people also varies a lot. Most of the time they tend to skip their breakfast and in most severe cases, even their lunch, due to which they end up having a problem of obesity, where there is an increased level of adiposity. A study done based on the obesity and infertility (Baheerati and Devi, 2018; Samuel and Devi, 2015), in this study, due to lack of vitamins in the body and many dietary intakes in a meal at wrong time predisposes to obesity.

The circadian rhythm also plays an influential role in the sleep-wake cycle (Rj and Devi, 2016; Fathima and P, 2016; Harsha *et al.*, 2015). There was research done on the topic of pathogenesis and novel drugs, and the result conveyed that this pathogenesis and novel drug can be used for the testament and the assessment of asthma (Dave and Preetha, 2016). The physical fitness among the dental physicians plays a vital role nowadays, and the physical fitness has been followed every day and is good for the maintenance of the body (David *et al.*, 2019; Shruthi and Preetha, 2018; Choudhari and Jothipriya, 2016). Scientific reports have explored the various physiological changes caused by Circadian rhythms. The symptoms and onset of disease in asthma and angina pectoris attacks occur during specific periods of 24 hour day, especially in the morning hours.

The most commonly used chronotherapy is corticosteroid medication. The impact of chronotherapeutics in the optimal treatment of diseased patients is made because in this method the treatment is done at the right time with the right medication at the right targeted site and in the right concentration. Since most of the people are of the evening types, in case of the patients who have asthma, their chronotherapeutic medication better in the evening types as it is related to the lungs. This is mainly used to ensure that the highest concentration of the synthetic hormone coincides in time with the morning peak of cortisol.

There are many studies which are done based on the causes and treatment in many of the diseases, and this survey has been a very important factor in the research field (Iyer *et al.*, 2019; Swathy and Sethu, 2015). Myocardial infarction is related to heart problems, and the study mainly discusses the regeneration, which is to be done after the occurrence of the myocardial infarction (Renuka and Sethu, 2015; Timothy *et al.*, 2019).

Limitations

In the present study, the sample size is less; an increase in sample size can still more cause a precision in our results. And also that cardiovascular and respiratory functions can also be evaluated to study the influence of circadian rhythm on the body.

Future Scope

The present study can further be extended by assessing the sleep quality of morningness-eveningness people and further evaluation of respiratory and cardiovascular parameters.

CONCLUSION

The study concludes that most of the maximum percentage of participants in the study were mostly an evening person. And also that most of the participants of the evening type used expenditure of energy. The influence of circadian rhythm on the morningness-eveningness of a person would be very high in the evenings. The morningness-eveningness attitude of a person is evaluated to check the level of activities he can do and the amount of energy that the person has and mainly what type of a person, whether a morning person or an evening person is evaluated. And based on the scale, the particular chronotherapeutics is given accordingly.

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