

INFLUENCE OF CIRCADIAN RHYTHMS ON LUNG FUNCTIONS AND SLEEP WAKE CYCLE.

Type of manuscript: Original article

Running Title: Influence of circadian rhythms on lung functions and sleep

SABARITHA. A¹, Dr.SRIDEVI. G²

Abstract: *Body is a biological clock where the cyclic process that occurs within every twenty-four hours is called circadian rhythm. Circadian rhythms are autonomous. Circadian rhythm helps to diagnose the onset and severity of the disease. Circadian rhythms are lost due to systemic inflammation. These rhythms are created and maintained by interactive positive and negative transcriptional and translational feedback loops. The understanding of how peripheral clocks drive physiology is relatively poor. Hence this study is done to identify when blocks occur during peak flow of circadian rhythms and to reduce the inflammation. The aim of this study is to determine the influence of circadian rhythms on lungs function and sleep cycle of normal healthy subjects the study is based on cross sectional analysis. A survey was conducted among random populations to study the influence of circadian rhythm on lung functions and sleep wake cycle using a questionnaire named morningness and eveningness scale. The questionnaire was distributed through an online survey link (i.e) google forms. Nearly 150 members participated in it. The results were collected and statistically analysed through spss software, version 22 and frequency and percentage analysis was used to present the data. Statistical analysis used was chi square test and the significance value was fixed at $p < 0.05$. The results showed that participants had difficulty in getting up from sleep with poor appetite. They felt more alert in the evening even till 11 PM. Evaluation on respiratory function revealed that most of the participants were normal, but in a few breathing difficulties was more pronounced in early mornings. The present study concluded that circadian rhythms influences lung function and breathing pattern which was assessed by the self-developed questionnaire and morningness eveningness scale analysis showed that circadian variation also influences their sleep and wake patterns in normal subjects.*

Keywords: *asthma, circadian rhythms, sleep awake cycle, breathing difficulties.*

1. INTRODUCTION:

Body is a biological clock where the cyclic process that occurs within every twenty four hours is called circadian rhythm (Truong et al., 2016). Circadian rhythms are intrinsic oscillations that occur due to cyclic environmental changes

¹Saveetha Dental College and hospital, Saveetha institute of medical and technical sciences, Chennai, India. Email: a.sabari2000@gmail.com

²Associate professor, Department of PHYSIOLOGY, Saveetha Dental College and Hospital, Saveetha institute of medical and technical sciences. Chennai, India.

³Corresponding author: Dr.SRIDEVI. G *

Associate professor, Department of PHYSIOLOGY, Saveetha Dental College and Hospital, Saveetha institute of medical and technical sciences. Chennai, India. Saveetha university, 162, Poonamallee High Road, Chennai – 600077, TamilNadu, India, Email: Sridevig.sdc@saveetha.com, Phone number :9840325676

(Truong et al., 2016). Circadian rhythm is otherwise known as endogenous rhythm which plays an important role in maintaining the physiological activity of the body (Truong et al., 2016). The most important key of circadian rhythm is the sleep wake cycle (Truong et al., 2016). Circadian rhythms are autonomous (Truong et al., 2016). Circadian rhythm helps to diagnose the onset and severity of the disease (Truong et al., 2016).

Circadian rhythms also fluctuate based on the abundance of the biomolecules (Haspel et al., 2014). Circadian rhythms are lost due to systemic inflammation (Haspel et al., 2014). The variations of the circadian rhythm may lead to stroke and myocardial infarction (Manfredini et al., 2004). These rhythms are controlled by suprachiasmatic nucleus (Gibbs et al., 2009)

In the previous research topics they have told that these rhythms are created and maintained by interactive positive and negative transcriptional and translational feedback loops (Gibbs et al., 2009). Circadian timers are known to be important for lung function (Gibbs et al., 2009). Glucocorticoid hormones, both endogenous and therapeutic, are known to modulate the phase of circadian gene expression in peripheral tissues (Gibbs et al., 2009). They conducted the study among smokers and non-smokers (Casale et al., 1992). Circadian associated regulators are members of proline and acidic amino acid - rich basic leucine zipper transcription factor (Chen et al., 2020). Circadian rhythms are embedded based on the operating system of organisms (Nosal, Ehlers and Haspel, 2020). Chronic circadian disturbance in humans and model organisms is associated with elevated heart disease rates, metabolic syndrome, and cancer (including lung cancer) over the long term (Nosal, Ehlers and Haspel, 2020). Circadian rhythms are regulated at the molecular level by oscillating core-clock genes which regulate the rhythmic expression of their downstream targets (Sengupta et al., 2019). Many physiological processes are subject to circadian control like immune response (Sengupta et al., 2019). Urine creatinine and extracellular vesicles do not have the same circadian rhythm (Koritzinsky et al., 2019). Circadian rhythms are synchronised, adapted, and modulated based on geographical factors (Mills, 2012). The 2017 Nobel Prize in Physiology or Medicine was jointly awarded to Jeffrey C. Hall, Michael Rosbash and Michael W. Young for their discoveries of molecular mechanisms controlling the circadian rhythm.

The aim of this study was to evaluate the influence of circadian rhythm on lung functions and sleep wake cycle using a questionnaire named morningness and eveningness scale.

2. MATERIALS AND METHODS:

Study setting:

The type of population taken is a random population with an age of 10 to 55 years. The questionnaire is based on cross sectional study. There are totally 150 students involved in this.

Sampling

The sample size is 150 students. The sampling method that is used is a simple random sampling method. The pattern of study design is observational study with subject's design. Measures are taken to minimise the sample bias with stratification and matching the independent variable with the selected samples

Total no of questions involved was 32 (Table 1 and 2). The types of questions involved are open ended and close ended questions. An online survey is done on a software called google forms. They are analysed and tabulated with question comparison. The mode of data representation is done through pie charts or bar graphs.

Parameters

Scale 1: Standard tool called morningness and eveningness scale was used to study the sleep quality and its effect on the subject.

Scale 2: Self developed questionnaire was used to access the lung functions and ill changes in the normal and asthmatic subject.

The impact of circadian rhythms on changes in the body will be accessed by the questionnaire designed for respiratory evaluations.

Statistical Analysis

The statistical software that is used is SPSS software version 22. The data was represented with frequency and cumulative percentage analysis and the statistical test used was chi square test and the significance value was fixed at $p < 0.05$

3. RESULTS AND DISCUSSION

Questionnaire 1

79.5% of the people do not have respiratory illness (Figure 1) and 20.5% of the people are suffering from respiratory illness. 80.8% of the people do not have asthma and 19.2% of people have asthma (Figure 2) . 88.7 % of the people are non-asthmatic so they did not take asthmatic drugs, 2% of the people used salbutamol, 3.3% of the people used Deriphylin and 6 % of the people used asthalin(Figure 3). 75.5% of the people do not know at what time and the need to take the drugs because they are non-asthmatic, 9.5% of the people take the drug at 8 AM, 7.7% of the people take a drug at 12 PM, 7.7% of the people take their drug at 4 PM (Figure 4). 75.5% of the people are not asthmatic And they are not aware of which time would asthmatic patients feel better, 6.3% of the asthmatic patient feel better at 8 AM., 9% of the asthmatic patients feel better at 12 PM , 9.3% of the Asthmatic patients feel better at 4 PM (Figure 5).63.5 % of the people are aware that asked Matic patient will have breathing difficulties and 26.5% of the people are not aware of it (Figure 6). 90.1% Of the random population do not have asthma so most of them are not aware of which time the asthmatic patients feel the worst, 1.3% of the patient Are having breathing difficulties during late night, 5.3% of the patient are having breathing difficulties during night and 3.3% of the patient are having breathing difficulties in the morning (Figure 7)

Questionnaire 2:Morningnesseveningness scale analysis

In the present study, the response of the participants whether they were alarm dependent (Figure 8), the responses were 20. 5% have chosen not to be dependent at all, 43% have chosen to be slightly dependent and the remaining 35% have chosen to be very dependent. Similar findings were made by Timothy etal(Morgenthaler et al., 2007), in the study , the participants were more dependent on the alarm for their morning routine, 72%. There are no previous studies with results in opposition.

In the present analysis, with adequate environmental conditions, how it was easy to get up in the morning (Figure 9), the responses were 39.7 percent opted it wasn't easy at all,27.2 percent opted it wasn't easy 15.9 percent opted it was relatively easy and 17.2 percent opted it was really easy. No previous papers containing opposing findings are available. In the present study, the alertness during the first half hour having woken in the morning (Figure 10), the responses were that 40.4% agree that they were not at all alert, 31.8% agree that they were slightly alert, 15.2% of the people agree that they

were fairly alert and 12.6% agree that they were very alert. There was a similar finding done (Thun et al., 2015), where the participants' responses was 55% were alert regarding the subject. There are no previous articles with opposing findings.

In the present study, appetite during the first half hour in morning the responses (Figure 11) were 12.6% of them say that appetite was very poor, 37.1% of them say that it was fairly poor 17.2% of the people say that it was fairly good and 12.6% of the people say it was very good. The appetite of the participants was fairly good during the first half an hour of morning. There was an opposing finding done (Oldham, Lee and Desan, 2016), where the responses recorded was that 58% of them were having a strong appetite during the normal morning routine. There are no previous articles with similar findings.

In the present study, the time of going to bed with no commitments on the next day (Figure 12) the responses were 30 percent chosen as rarely or never late, 42.4 percent opted as 1-2 hours late and 29.8 percent opted as more than 2 hours or late. There are no previous studies with results in opposition.

In the present study, the level of tiredness when they went to bed at 11 pm (Figure 13), the responses were 21.2 percent preferred as not tired at all, 36.4 percent preferred as less tired and 33.3 percent preferred as very tired. A similar analysis was carried out by Aarthy (Abigail et al., 2019), where the analysis concluded the same conclusion with the 82 percent score.

In the present study, the time in the evening when they were tired (Figure 14), 40% of the people prefer that it is 10-12 pm, 36% of them prefer 9 - 10 pm, 10% of the people prefer 8-9 pm, 12% of the people prefer 12-3 am. A similar analysis was carried out by Aarthy (Abigail et al., 2019), where the analysis concluded the same conclusion with the 62 percent score.

So, the participants of the study were evening type of person for they were more alert in the evening.

In the present study, consider only your best with the rhythm at what time would you get up in the morning (Figure 15), 43.7% of the people felt that the correct time to get up in the morning was 6:30 to 7:30 AM, 37.1% of the people felt that the correct time to get up in the morning 7: 30 to 9 AM, 13.2% of the people felt that the correct time to get up in the morning is 5 to 6:30 AM, 6% of the people felt that the correct time to get up in the morning is 12 to 12 AM. There are no previous studies with results in opposition.

In the present study, Representing the morning type and evening type of people in (Figure 16), 40.4% of the people are morning type when than being an evening type, 19.2 % of the people or evening type rather than being a morning type, 28% of the people prefer to be a morning type, 9.9% of the people prefer to be an evening type there are no opposing articles regarding this.

The circadian rhythm is the changes in physical, mental, and behaviour, which follow a daily cycle. They primarily respond to the light and darkness within the environment of an organism. Typically, when the circadian rhythm is considered, there are 3 types of people for whom this circadian rhythm feature can be tested, they are the morning person, the evening person or the night person. Recent investigations have shown that regulation of hormonal function do affect the circadian rhythms (Samuel and Devi, 2015). Changes in circadian rhythms are associated with temporal alterations in feeding behaviour and increased weight gain (Baheerati and Gayatri Devi, 2018) (Fathima and Preetha, 2016; Baheerati and Gayatri Devi, 2018). The circadian rhythm helps to determine our sleep pattern (Rj and R, 2016).

The body's master clock or SCN controls the production of melatonin that makes us feel sleepy (Rj and R, 2016). The circadian pattern of bilirubin is altered in individuals with abnormal sleep (Harsha et al., 2015). It has been demonstrated that nocturnal symptoms of cough and Dyspnea are accompanied by circadian variations in airway inflammation including airflow limitations (Dave and Preetha, 2016). Diurnal variations of bodily functions is affected in such a way that impact of circadian rhythm alters homeostasis (Abigail et al., 2019). Some evidence indicates that physical activity can promote the synchronisation of circadian rhythmicity and ultimately reduce the risk of cardiovascular diseases like myocardial infarction (David et al., 2019)(Renuka and Sethu, 2015). Circadian rhythms can participate in lipid, glucose, cholesterol metabolism and are closely related to other metabolism (Shruthi and Preetha, 2018 ; Iyer, Gayatri Devi and Jothi Priya, 2019)

Circadian rhythms are also influencing the adenoids (R and Sethu, 2018). Some factors indicate the association between circadian rhythm, sleep, risk of IVD degeneration and low back pain (Swathy and Gowri Sethu, 2015). Circadian rhythm plays an important role in reducing air flow resistance and alters peak expiratory flow rate (PEFR) (Timothy, Gayatri Devi and Jothi Priya, 2019). In addition to synchronizing the sleep-wake cycle, circadian rhythms play an important role in the onset and severity of diseases (Truong et al., 2016). Many diseases have well-documented diurnal variability. Myocardial infarction, ischemic stroke and sudden cardiac death, all peak in frequency between the hours of 8:00 a.m. and 10:00 a.m., compared with the hours between 9:00 p.m. and 11:00 p.m. (Truong et al., 2016). Circadian rhythm disruption will lead to negative health outcomes, especially shift workers. Sleep-wake cycle will influence the functions of immune system of the body. Chronotherapy is used in the treatment of asthma. (Truong et al., 2016). In the case of long-acting β_2 -agonist salmeterol, 100 μg provided at night is as beneficial as 50 μg twice daily in preventing bronchial asthma attacks in patients otherwise difficult to control. Understanding the regular essence of pathophysiology and the diurnal impact of treatment is critical for asthma management.

TABLE -1 CUMULATIVE PERCENTAGE OF RESPONSES FOR THE QUESTIONS

S.NO	QUESTIONS	OPTIONS	RESPONSES
1	If there is a specific time at which you have to get up in the morning at what extent are you dependent on being woken up by an alarm	Not at all dependent Slightly dependent Fairly dependent Very dependent	12.6 % 23.8 % 43.0 % 20.5 %
2	Assuming adequate environmental conditions, how easy do you find to get up in the morning	Not at all easy Not very easy Fairly easy Easy	17.2 % 27.2% 39.7% 15.9%
3	How alert do you feel during the first half an hour after doing work in the morning	not at all alert Slightly alert Fairly alert Very alert	12.6% 40.4% 31.8% 15.2%
4	How is your appetite during the first half an hour after doing work in the morning	Very poor Fairly poor	12.6% 37.1%

		Fairly good Very good	33.1% 17.2%
5	During the first half an hour after having worked in the morning how tired do you feel	Very tired Fairly tired Fairly refreshed Very refreshed	13.9% 27.8% 38.4% 19.9%
6	When you have no commitments the next day, at what time do you get up from bed when compared to your usual bedtime	Seldom Less than an hour One to 2 hours More than two hours	17.2% 29.8% 40.4% 12.6%
7	One hears about morning type in evening type of people, which one of these types do you consider yourself to be	Definitely a morning type Rather a morning than evening type Rather a evening than morning type Definitely a evening time	19.2% 42.4% 28.5% 9.9%
8	If you are going to bed at 11 PM what kind of tiredness would you feel	Not at all tired A little tired Fairly tired Very tired	10.6% 31.8% 36.4% 21.2%
9	At what time in the evening do you feel tired as a result in the need of sleep	8 to 9 pm 9 to 10 PM 10 to 12PM 12 to 3 AM	13.9% 36.4% 40.4% 9.3%
10	Consider only your best with rhythm, at what time would you get up in the morning	5 to 6:30 am 6:30 to 7: 30 am 7:30 to 9 am 12 to 12 am	13.2% 43.7% 37.1% 6.0%

TABLE 2: CUMULATIVE PERCENTAGE OF RESPONSES FOR THE QUESTIONS RELATED TO ASTHMA

S.NO	QUESTIONS	OPTIONS	RESPONSES
1	Do you have any respiratory illness	yes No	20.5% 79.9%
2	Do you have asthma	yes No	19.2% 80.8%
3	If you are and asthmatic what drugs are you using	asthalin Deriphyllin Salbutamol Nil	6% 3.3% 2% 88.7%
4	if you are an asthmatic at what time do you have to take your drug	8 AM 10 PM 4 PM Not relevant	9.9% 7.3% 7.3% 75.5%

5	If you are and asthmatic hen do you feel that you are doing better	8 AM 10 PM 4 PM Not relevant	6.3% 9.0% 9.3% 75.5%
6	If you are asthmatic do you have breathing difficulty	yes No	63.5% 26.5%
7	If you are an asthmatic when do you have the worst breathing difficulty	morning Night Late night Nil	3.3% 5.3% 1.3% 90.1%

4. BAR GRAPHS

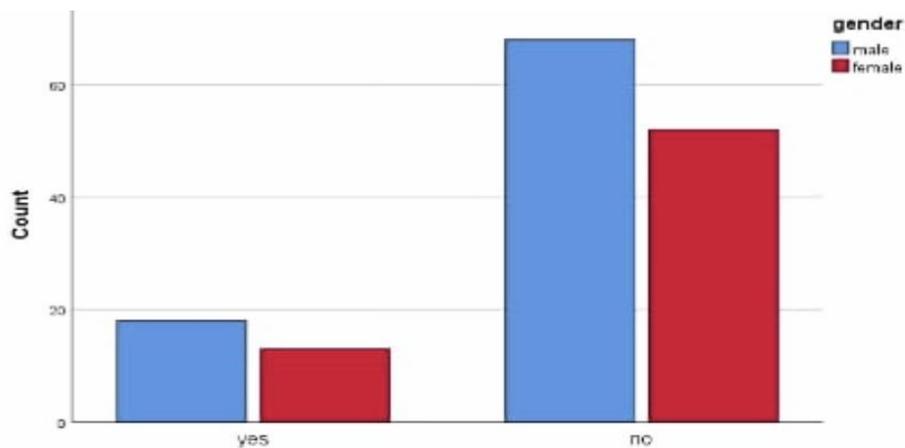


Figure -1: Bar graph depicting the association between gender and the total count of responses on respiratory illness. Blue colour represents the male participants and red colour represents a female participant. X axis represents the gender and Y axis represents the total count of responses on respiratory illness. Out of the total participants 19 % of the participants were male who had respiratory illness and 14 % of female participants who had respiratory illness. Association between and total count of responses on respiratory illness was done using Chi square test, Pearson chi square is 0.889; df=1; p value = 0.020(p<0.05) was found not significant.

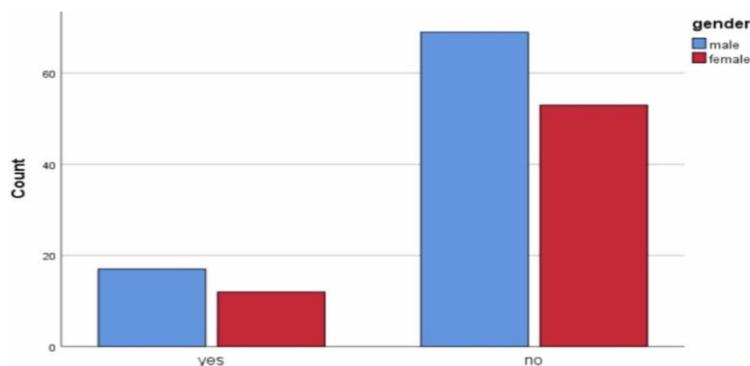


Figure 2: The bar graph depicting the association between the gender and the total count of responses of patients who have asthma. The blue colour represents the male and the red colour represents the female participants with asthma. X axis represents the gender and Y axis represents the total count of responses on patients who have asthma.

Out of the total participants 18 % of the participants were male who had asthma and 16 % of female participants who had asthma. Association between gender and total count of responses on asthma was done using Chi square test , Pearson chi square is 0.041 ; df=1; p value = 0.840 (p<0.05) was found not significant.

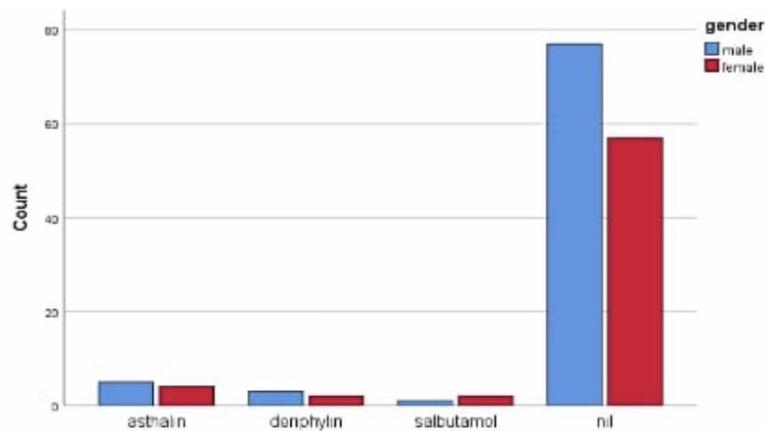


Figure 3: The bar graph depicting the association between the gender and the drugs used by the asthmatic patient. The blue colour represents the mail and the red colour represents a female. X axis represents the gender and Y axis represents the number of responses based on the drugs used by the asthmatic patients. Out of the total male participants 5 % used asthalin, 4 % used Deriphylin , 2 % used salbutamol and out of total female participants 4% used asthalin, 3 % used deriphyllin , 3% used salbutamol. Association between gender and total count of responses on asthmatic drugs was done using Chi square test, Pearson chi square is 0.723, df =3; p value = 0.868 (p<0.05) was found not significant.

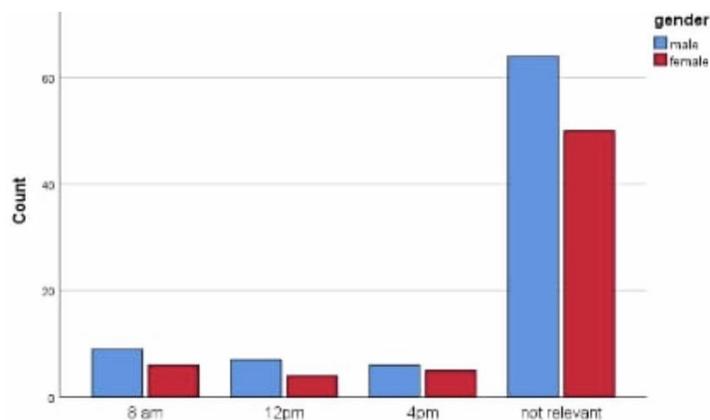


Figure 4: The bar graph depicting the association between gender and the total count of responses on the timings for the usage of asthmatic drugs. The blue colour represents the male and the red colour represents a female. X axis represents the gender and Y axis represents the total count of responses on the timings for the usage of asthmatic drugs. Out of the total male participants 3% of the participants took their drug at 4 PM , 5% of the participants took their drugs at 12 PM and 8% of the participants took the drugs at 8 AM. Out of the total female participants 2% of the participants took the drugs at 4 PM and 1.5% of the participants to get drug at 12 PM and 5% of the participants took their drug at 8 AM . Association between gender and total count of responses on the timings for the usage asthmatic

drugs was done using Chi square test, Pearson chi square is 0.974, df =3; p value = 0.231 (p<0.05) was found not significant.

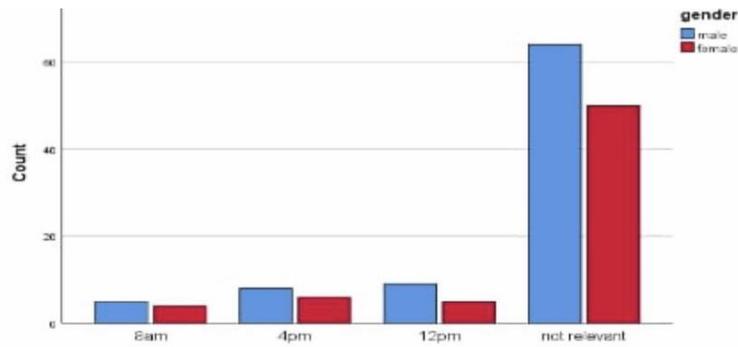


Figure 5: The bar graph depicting the association between the gender and the total count of responses of asthmatic patients feeling better at a particular day. The blue colour represents a male the right colour represents a female. X axis represents the gender and Y axis represents the betterment of asthmatic patients at 4 PM every day .Out of the total male participants 8% of the male participants felt that they can breathe better at 12 PM, 7% of the male participants felt that they can breath better at 4 PM, 5% of the male participants felt that they can breathe better at 8 AM. Out of the total female participants 5% of the female participants felt that they can breathe better at 12 PM, 6% of the female participants felt that they can breathe better at 4 PM, 3% of the female participants felt that they can breathe better at 8 AM.Association between gender and total count of responses on the timings where the sthmatic patients have better breathing was done using Chi square test , Pearson chi square is 0.345 ,df =3; p value = 0.971 (p<0.05) was found not significant.

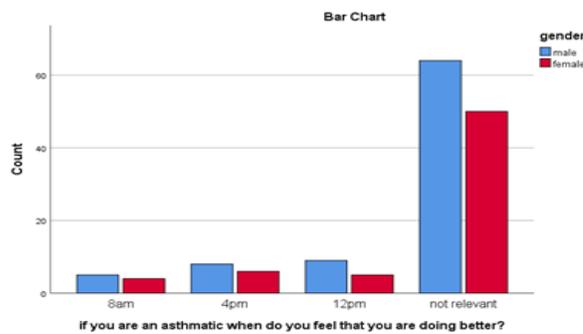


Figure 6: The bar graph depicting the association between the gender and the responses based on asthma leading to breathing difficulties. The blue colour represents the male, the red colour represents a female.X axis represents the gender and Y axis represents the number of responses based on asthma leading to breathing difficulty. 46% of male participants and 36% of female participants a few percent of the people were not aware that asthma will lead to breathing difficulties. Association between gender and total count of responses on the timings where the asthma leading to breathing difficulties as done using Chi square test, Pearson chi square is 0.286, df =2; p value = 0.867 (p<0.05) was found not significant.

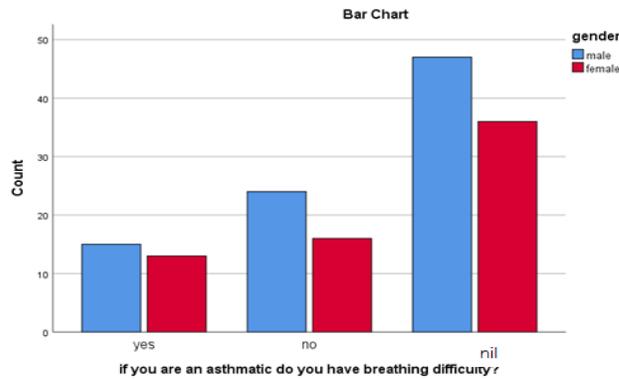


Figure 7: The bar graph depicting the association between gender and the number of responses based on breathing difficulty in asthmatic patients in each period of a day. The red colour represents the female and the blue colour represents the male. X axis is the gender and Y axis is based on the number of responses based on breathlessness in asthmatic patients in each period of a day. Out of the total male participants 5% of the male participants felt difficulty in breathing in the morning, 7% of the male participants said difficulty in breathing in the night, 3% of the male participants during late night. Out of the total female participants 3% of the female participants felt difficulty in breathing during late night, 5% of the participants felt difficulty breathing in the night, 2% of the participants for the difficulty of breathing. Association between gender and total count of responses on the timings of breathlessness was done using Chi square test, Pearson chi square is 0.225, df =3; p value = 0.093 (p<0.05) was found not significant.

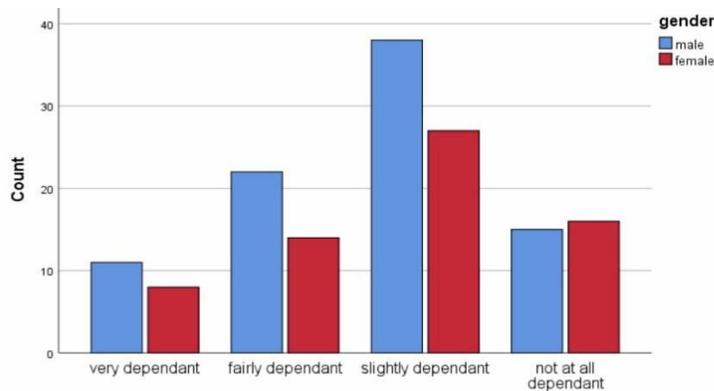


Figure 8: The bar graph representing the association between the gender and the number of responses on dependance on alarm in the morning. Blue colour represents the and red colour represents a female. X axis represents the gender and Y axis represents the responses given by the random population based on using an alarm to wake up in the morning. About 38% of the males were slightly dependent and 26% of females were slightly dependent. The association between the gender and the number of responses depending on alarm in the morning was done in Chi square test. Pearson chi-square value is 0.249; df= 3 ; p value = 0.714 p< 0.001 = statistically not significant .

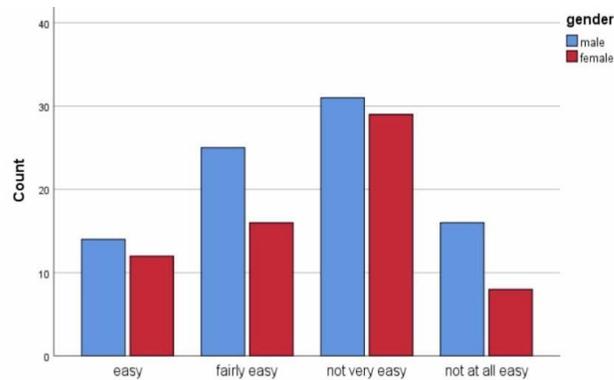


Figure 9: The bar graph depicting the association between gender and the number of responses based on adequate environmental conditions to wake up in the morning. The red colour represents the female and the blue colour represents the male. However, it is statistically not significant X axis represents gender and Y axis represents the number of responses based on adequate environmental conditions to wake up in the morning. About 32 % were not very easy and 28% of female were also not very easy in waking up in the morning. The association between gender and the number of responses based on adequate environmental conditions to wake up in the morning was done by chi square test. (Pearson chi-square value = 1.567, df= 3 p value = 0.576; $p < 0.001$ statistically not significant)

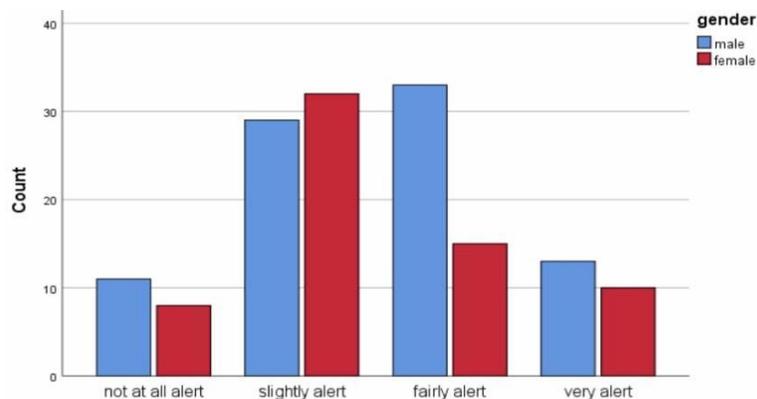


Figure 10: The bar graph depicting the association between the gender and the number of responses on alert do you feel after the first half an hour of work in the morning. The red colour represents the female and the blue colour represents the male. The X axis represents the gender and the Y axis represents the number of responses on alert do you feel after the first half an hour of work in the morning. About 32% were fairly alert in the first hour of work in morning and 32% female were slightly alert after the first half hour of work in the morning. the association between the gender and the number of responses on alert do you feel after the first half an hour of work in the morning as done by chi square test, Pearson chi-square test value = 1.876, df= 2, p value = 0.176; $p < 0.001$ statistically not significant)

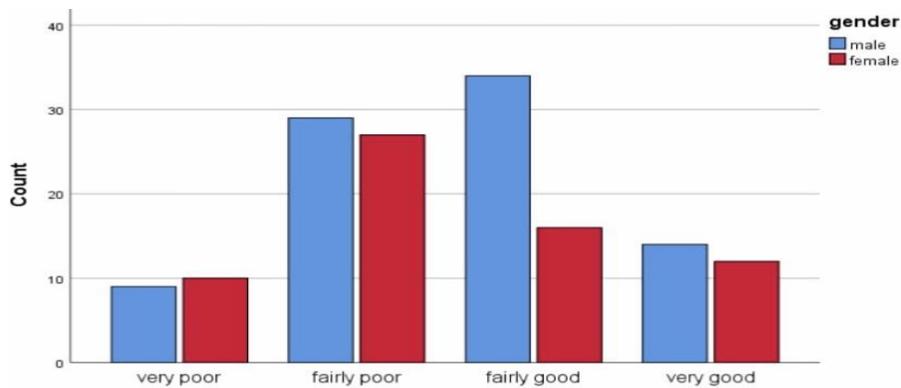


Figure 11: The bar graph depicting the association between the gender and the number of responses based on the appetite of us half an hour of having worked in the morning. The blue colour represents the male and the red colour represents a female. X axis represents the gender and Y axis represents the responses based on appetite of the first half an hour of having worked in the morning. About 34% of male had fairly good appetite and 26% of female had poor appetite. The association between the gender and the number of responses based on the appetite of us half an hour of having worked in the morning was done by chi square test. (Pearsons chi-square value = 1.564 , df= 2, p = 0.271; $p < 0.001$ = statistically not significant).

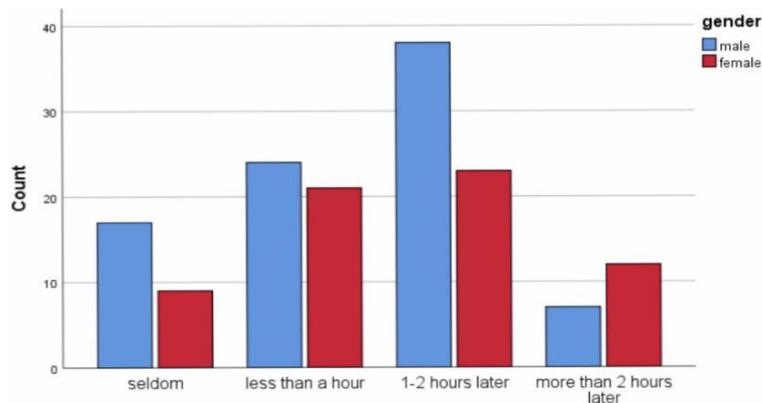


Figure 12: The bar graph representing the association between the gender and the number of responses given by the population at what time they would get up in the morning when they do not have any commitments the next day. The red colour represents female and the blue colour represents male. The X axis represents the gender and the Y axis represents the number of responses given by the population at what time they would get up in the morning when they do not have any commitments the next day. About 38 % of male get up 1-2 hr later, but 24% of female get up 1-2 hr late. The association between the gender and the number of responses given by the population at what time they would get up in the morning when they do not have any commitments the next day. was done chi square test. (Pearson Chi Square value is 1.342, df= 2, $p = 0.184$; $p < 0.001$ = statistically not significant)

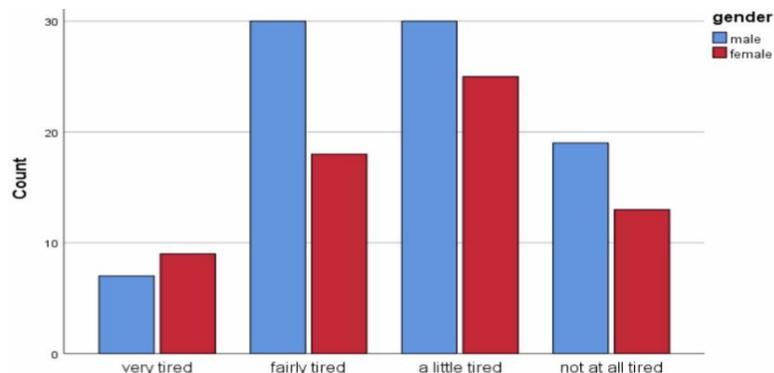


Figure 13: The bar graph depicting the association between the gender number of responses based on the level of tiredness when they go to bed at 11 PM. Red colour represents the number of females and blue colour represents the number of males. The X axis represents the gender on the Y axis represents the responses based on the level of tiredness when they go to bed at 11 PM. About 30 % of male were fairly tired and little tired and 26% of female were little tired. the association between the gender number of responses based on the level of tiredness when they go to bed at 11 PM was done by Chi square test. (Pearson chi-square value is 1.564, df= 3, p value = 0.584; $p < 0.001$ = statistically not significant)

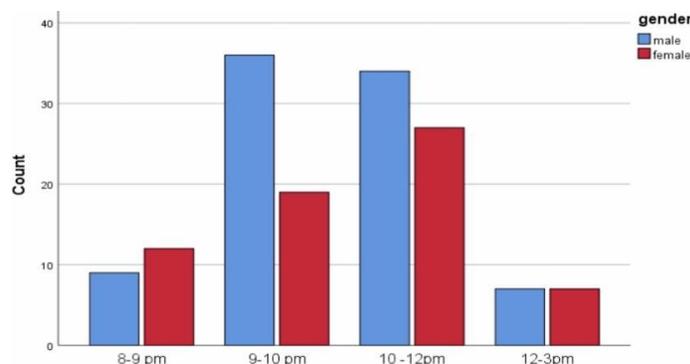


Figure 14: The bar graph depicting the association between the gender and the number of responses based on how tired we are in the evening resulting in the need of sleep. Red colour represents the female and blue colour represents the male. X axis represents the gender and Y axis represents the number of responses based on how tired we are in the evening resulting in the need of sleep. 38 % of male were tired by 9-10 pm and 27% of female were tired at 10-12 pm The the association between the gender and the number of responses based on how tired we are in the evening resulting in the need of sleep was done by chi square test (Pearson chi-square value is = 1.245 ,df= 2, p = 0.304; $p < 0.001$ = Statistically not significant)

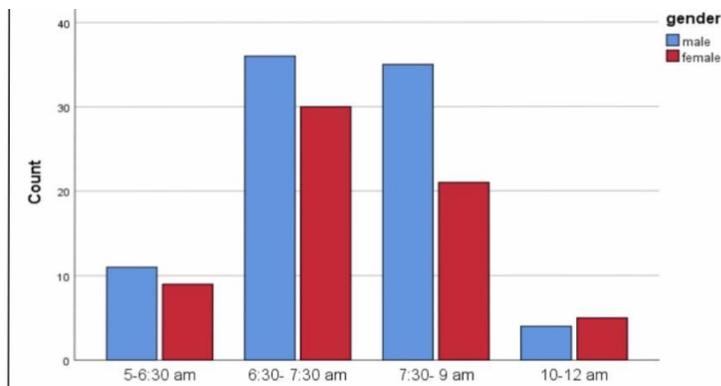


Figure 15: Bar graph depicting the association between the gender and the number of responses based on considering the best rhythm of time for ourselves to get up in the morning. Red colour represents the female and blue colour represents the male. X axis represents a gender and Y axis represents the number of responses based on considering the best return of time for ourselves to get up in the morning. About 38% males felt the best rhythm at 6.30 -7.30, but 30 % females consider 6.30 -7.30 as the best rhythm. The association between the gender and the number of responses based on considering the best rhythm of time for ourselves to get up in the morning. However, it is statistically not significant, (Pearson chi-square value = 1.245; df= 3, p = 0.691; p < 0.001= Statistically not significant)

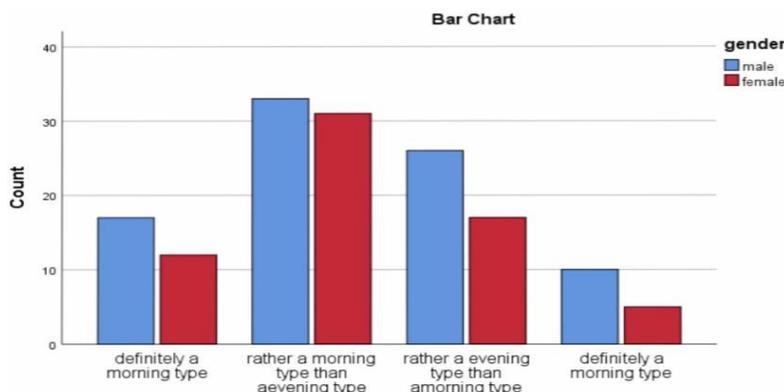


Figure 16: The bar graph depicting the association between gender and the responses based on what type of person either morning, evening or either types. Red colour represents the females and blue colour represents the males. X axis represents the gender and Y axis represents the number of responses based on what type of person. Most of male 36% were rather morning or evening type and 32% of females were rather morning or evening. The association between gender and the responses based on what type of person either morning, evening or either types by Chi square test. (Pearson chi-square value is 1.585; df= 2, p value = 0.663 p<0.001= Statistically not significant)

5. LIMITATIONS:

In the present study, the sample size is less and even the population size is less which is 50. if more samples were used the assessment of lung functions caused by circadian rhythms could have been studied better, also a spirometry and other lung functions parameters could have been assessed. Special emphasis on asthma participants and their time of

bronchodilator administration could have been analysed. Also, neurophysiological changes in sleep wakefulness cycle could have been evaluated.

6. IMPLICATIONS AND FUTURE SCOPE:

This study throws light on the influence of circadian rhythms on respiratory functions and sleep cycle. These findings would be of considerable importance in chronotherapeutic medication in asthmatic subjects.

7. CONCLUSION

The present study showed that most of the participants had difficulty in getting up from sleep with poor appetite. They felt more alert in the evening even till 11 PM. Evaluation on respiratory function revealed that most of the participants were normal, but in a few breathing difficulties was more pronounced in early mornings. Thus, it can be concluded that circadian rhythms influence lung function and breathing pattern and also the sleep wake patterns in the participants.

REFERENCE

1. Abigail et al. (2019) 'Evaluation of Muscular Endurance among Dentists', Indian Journal of Public Health Research & Development, p. 258. doi: 10.5958/0976-5506.2019.02808.0.
2. Baheerati, M. M. and Gayatri Devi, R. (2018) 'Obesity in relation to Infertility', Research Journal of Pharmacy and Technology, p. 3183. doi: 10.5958/0974-360x.2018.00585.1.1
3. Casale, R. et al. (1992) 'Circadian rhythm of peak expiratory flow in children passively exposed and not exposed to cigarette smoke', Thorax, 47(10), pp. 801–803.
4. Chen, J. et al. (2020) 'Downregulation of the circadian rhythm regulator HLF promotes multiple-organ distant metastases in non-small cell lung cancer through PPAR/NF- κ b signaling', Cancer Letters, pp. 56–71. doi: 10.1016/j.canlet.2020.04.007.
5. Dave, P. H. and Preetha (2016) 'Pathogenesis and Novel Drug for Treatment of Asthma-A Review', Research Journal of Pharmacy and Technology, p. 1519. doi: 10.5958/0974-360x.2016.00297.3.
6. David et al. (2019) 'Physical Fitness among the Dental Physician, Dental Undergraduates and Postgraduates Students', Indian Journal of Public Health Research & Development, p. 223. doi: 10.5958/0976-5506.2019.02801.8.
7. Fathima, F. and Preetha, P. (2016) 'EVALUATION OF THYROID FUNCTION TEST IN OBESE PATIENTS', Asian Journal of Pharmaceutical and Clinical Research, p. 353. doi: 10.22159/ajpcr.2016.v9s3.12959.
8. Gibbs, J. E. et al. (2009) 'Circadian Timing in the Lung; A Specific Role for Bronchiolar Epithelial Cells', Endocrinology, pp. 268–276. doi: 10.1210/en.2008-0638.
9. Harsha, L. et al. (2015) 'Systemic Approach to Management of Neonatal Jaundice and Prevention of Kernicterus', Research Journal of Pharmacy and Technology, p. 1087. doi: 10.5958/0974-360x.2015.00189.4.
10. Haspel, J. A. et al. (2014) 'Circadian rhythm reprogramming during lung inflammation', Nature Communications. doi: 10.1038/ncomms5753.
11. Iyer, P. K., Gayatri Devi, R. and Jothi Priya, A. (2019) 'A Survey Study on Causes, Treatment and Prevention of Onychocryptosis', Indian Journal of Public Health Research & Development, p. 807. doi: 10.5958/0976-5506.2019.01990.9.
12. Koritzinsky, E. H. et al. (2019) 'Circadian variation in the release of small extracellular vesicles can be normalized by vesicle number or TSG101', American journal of physiology. Renal physiology, 317(5), pp. F1098–F1110.
13. Manfredini, R. et al. (2004) 'Influence of circadian rhythm on mortality after myocardial infarction: Data from a prospective cohort of emergency calls', The American Journal of Emergency Medicine, pp. 555–559. doi: 10.1016/j.ajem.2004.08.014.
14. Mills, J. (2012) Biological Aspects of Circadian Rhythms. Springer Science & Business Media.
15. Morgenthaler, T. I. et al. (2007) 'Practice parameters for the clinical evaluation and treatment of circadian rhythm sleep disorders. An American Academy of Sleep Medicine report', Sleep, 30(11), pp. 1445–1459.

16. Nosal, C., Ehlers, A. and Haspel, J. A. (2020) 'Why Lungs Keep Time: Circadian Rhythms and Lung Immunity', *Annual review of physiology*, 82, pp. 391–412.
17. Oldham, M. A., Lee, H. B. and Desan, P. H. (2016) 'Circadian Rhythm Disruption in the Critically Ill: An Opportunity for Improving Outcomes', *Critical care medicine*, 44(1), pp. 207–217.
18. Renuka, S. and Sethu, G. (2015) 'Regeneration after Myocardial Infarction', *Research Journal of Pharmacy and Technology*, p. 738. doi: 10.5958/0974-360x.2015.00117.1.
19. R, G. D. and Sethu, G. (2018) 'EVALUATION OF ADENOIDS BY ORONASAL AND NASAL SPIROMETRY', *Asian Journal of Pharmaceutical and Clinical Research*, p. 272. doi: 10.22159/ajpcr.2018.v11i10.27365.
20. Rj, I. and R, G. D. (2016) 'Role of environmental factors on sleep patterns of different age groups', *Asian Journal of Pharmaceutical and Clinical Research*, p. 124. doi: 10.22159/ajpcr.2016.v9i6.13832.
21. Samuel, A. R. and Devi, M. G. (2015) 'Geographical distribution and occurrence of Endemic Goitre', *Research Journal of Pharmacy and Technology*, p. 973. doi: 10.5958/0974-360x.2015.00162.6.
22. Sengupta, S. et al. (2019) 'Circadian control of lung inflammation in influenza infection', *Nature Communications*. doi: 10.1038/s41467-019-11400-9.
23. Shruthi, M. and Preetha, S. (2018) 'Effect of Simple Tongue Exercises in Habitual Snorers', *Research Journal of Pharmacy and Technology*, p. 3614. doi: 10.5958/0974-360x.2018.00665.0.
24. Swathy, S. and Gowri Sethu, V. (2015) 'Acupuncture and lower back pain', *Research Journal of Pharmacy and Technology*, p. 991. doi: 10.5958/0974-360x.2015.00165.1.
25. Thun, E. et al. (2015) 'Sleep, circadian rhythms, and athletic performance', *Sleep Medicine Reviews*, pp. 1–9. doi: 10.1016/j.smr.2014.11.003.
26. Timothy, C. N., Gayatri Devi, R. and Jothi Priya, A. (2019) 'Evaluation of Peak Expiratory Flow Rate (PEFR) in Pet Owners', *Indian Journal of Public Health Research & Development*, p. 803. doi: 10.5958/0976-5506.2019.01989.2.
27. Truong, K. K. et al. (2016) 'Timing Matters: Circadian Rhythm in Sepsis, Obstructive Lung Disease, Obstructive Sleep Apnea, and Cancer', *Annals of the American Thoracic Society*, 13(7), pp. 1144–1154.