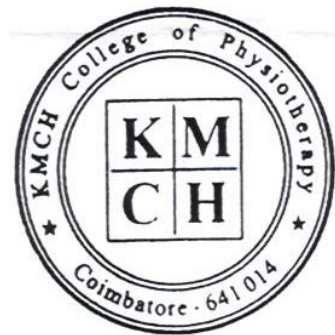


# **EFFECT OF OROPHARYNGEAL EXERCISES ON SNORERS**

**- An Experimental study**

Dissertation submitted to The Tamilnadu Dr. M.G.R. Medical University towards partial fulfillment of the requirements of **MASTER OF PHYSIOTHERAPY (Advanced PT in Cardio-Pulmonary Diseases)** Degree Programme.



## **KMCH COLLEGE OF PHYSIOTHERAPY**

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**2010-2012**

## **CERTIFICATE**

This is to certify that research work entitled **“EFFECT OF OROPHARYNGEAL EXERCISES ON SNORERS” – An Experimental study** was carried out by the candidate bearing the **Register No: 27101616**, KMCH College of Physiotherapy towards partial fulfillment of the requirements of the **Master of Physiotherapy (Advanced PT in Cardio-Pulmonary Diseases)** under The Tamil Nadu Dr. M.G.R. Medical University, Chennai-32.

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### **EXTERNAL EXAMINER**

Project Evaluated on:

# **ACKNOWLEDGEMENT**

## ACKNOWLEDGEMENT

I take this opportunity to express my sincere devotion to **The Supreme Almighty** for His guidance and blessings throughout this study.

I'm deeply indebted to **My Beloved Parents** for their unconditional love, sincere prayers, encouragement, constant inspiration and care without which I would not have accomplished anything.

My sincere thanks to the KMCH Management, especially to the Chairman **Dr. Nalla G. Palaniswami** M.D. (AB), and the Trustee **Dr. Thavamani D.Palaniswami** M.D. (AB) F.A.A.P., who are the stalwarts of the institute.

I thank **Dr. O.T. Bhuvaneshwaran** PhD, Chief Executive Officer, for his intensive efforts towards the academics.

My sincere thanks to **Dr. Edmund M.D'Couto**, M.B.B.S., D.Phys. Med & Rehab, Principal, KMCH College of Physiotherapy, for his valuable support.

I express my heartiest thanks in this instance to my project guide and Vice principal **Mrs. A.P.Kalpna, M.P.T. (Cardio)**, for her benevolent guidance, support and valuable suggestions throughout the course of the study.

My heartfelt thanks to my class in-charge **Mrs. A. Brammatha, M.P.T. (Neuro)**, Professor, for her guidance and encouragement throughout the study.

I extend my gratitude to **Mr. K. Venugopal, M.A., M.Phil**, Professor in Research & Biostatistics for letting me know the intricacies of Biostatistics.

I wish to express my thanks to all **the faculty members** for their support.

I perpetuate my thanks to librarian, **Mr. P. Dhamodharan** and his fellow members for their co-operation and patience in providing books for reference, which helped me to complete this project successfully.

I express my hearty thanks to all my **subjects** for their active participation and co-operation.

Last but not the least I would like to express my hearty thanks to all my **classmates and friends** for their active participation and co-operation without which this study would not have progressed to be successful.

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# **ABSTRACT**

# **ABSTRACT**

## **OBJECTIVES:**

To analyze the effect of oropharyngeal exercises on day time sleepiness, sleep quality, snoring frequency and intensity and neck circumference among snorers.

## **STUDY DESIGN:**

Pre-test and Post-test experimental study

## **METHODOLOGY:**

Subjects were assigned into two groups with 15 in group A and 15 in group B. Group A subjects underwent oropharyngeal exercises and life style modifications while the Group B for lifestyle modifications only.

Oropharyngeal exercises consists of exercises to face, tongue and functional activities for 30 minutes daily lasted for 6 weeks .Life style modifications insisted to sleep on side and modification of risk factors .

## **OUTCOME MEASURES:**

Day time sleepiness was measured by using Epworth day time sleepiness scale , Sleep quality was measured with the help of Pittsburgh sleep quality index ,Snoring frequency and intensity were measured by using Berlin questionnaire and Neck circumference was measured with the help of Inch tape.

## **RESULTS:**

The data were analysed using Independent and Paired't' test at 5% level of significance. There was significant difference between the groups in all the outcome measures except in neck circumference. There was significant improvement on day time sleepiness, sleep quality and snoring frequency in both the groups. But snoring intensity and neck circumference were improved in group A subjects alone.

## **CONCLUSION:**

This study revealed that there is significant improvement in snoring and its associated features on subjects who underwent oropharyngeal exercises and life style modifications.

# **INTRODUCTION**

# 1. INTRODUCTION

“Laugh and the world laughs with you, snore and you sleep alone” – Anthony Burgess

The passing of air through the obstructed pathway produces characteristic sound known as ‘snoring’.

Urbanization has led to an increase in number of people leading a sedentary life style. This sedentary life style has led to a proportional increase in the diseases caused by risk factors. Common man does not recognize snoring as a medical problem but it is actually a medical condition.

People who usually snore have excess weight, increased neck circumference, alcoholic, smoker, narrowed airway and majority of them are males.

Above mentioned risk factors may alter the upper airway patency. This is because the muscle loosens its tone and obstructs the pathway during sleep which leads to snoring. This leads him into headache upon waking, depressed mentation and altered personality. This will disturb the sound sleep of the partner too.

If left untreated, it may lead to sleep apnea and excessive day time sleepiness which in turn leads to reduced performance at work, fatal road traffic accidents and disturbances in familial relationship. Sleep apnea should associate with snoring but not everyone who snores has obstructive sleep apnea.

Thus snoring needs to be treated. The common treatment procedures used are frequent side changing and life style changes like advice to reduce weight, quit smoking and abstinence from alcoholism.

The muscles which are maintaining the upper patency are palato pharyngeous, palatoglossus, uvula, tensor veli palatine, orbicularis oris, buccinator, minor zygomaticus, levator labii superioris, and lateral pterygoid and medial pterygoid muscles. The loosening of these structures leads to the obstruction of air pathway, which leads to snoring during sleep in supine position. Strengthening of these muscles helps to reduce the same. Here the role of oropharyngeal exercises assumes its significance.

In India number of people with risk factors for snoring is steadily increasing. This inturn might lead to an increase in the number of sleep apneics and also a rise in the familial and social problems faced by such individuals. The role of physiotherapy in sleep disorders has not been explored. This study aims to look at the effects of oropharyngeal exercise, on a daily basis when the patient is awake and active, on habitual snoring.

# **LITERATURE REVIEW**

## 2. LITERATURE REVIEW

Snoring is not a problem for the snorer alone but a problem for the partner also. It becomes a serious problem for the snorer when it ends up in complications. Awareness about the condition is lacking among habitual snorers. But they do suffer as a result of the same. So it is necessary to treat the sleep disorders.

### 2.1 DEFINITION OF SNORING

**Kryger et al** revealed that snoring is a noise produced when an individual breathes during sleep which in turn causes vibration of the soft palate and uvula<sup>19</sup>.

**British snoring and sleep apnea association** defined snoring as a coarse sound made by vibrations of the soft palate and other tissue in the mouth, nose and throat<sup>5</sup>.

### 2.2 RISK FACTORS FOR SNORING

**British snoring and sleep apnea association** concluded the risk factors as over eating, lack of exercise, alcohol and sleeping pills, smoking, sleeping position, allergy, nasal stiffness, small or collapsing nostrils and multi -factorial snoring<sup>4</sup>.

### 2.3 PATHOGENESIS OF SNORING

**Remmers et al** came to the conclusion that upper air way resistance increased dramatically due to pharyngeal airway collapse and obstruction of inspiratory airflow<sup>26</sup>.

**Jason et al** proposed that increased fat deposition in the walls of pharynx may predispose to air way obstruction during sleep<sup>12</sup>.

**Katia C. Guimares et al** concluded that upper airway muscle function has major role in the maintenance of the upper airway patency and this contributed to the genesis of obstructive sleep apnea<sup>17</sup>.

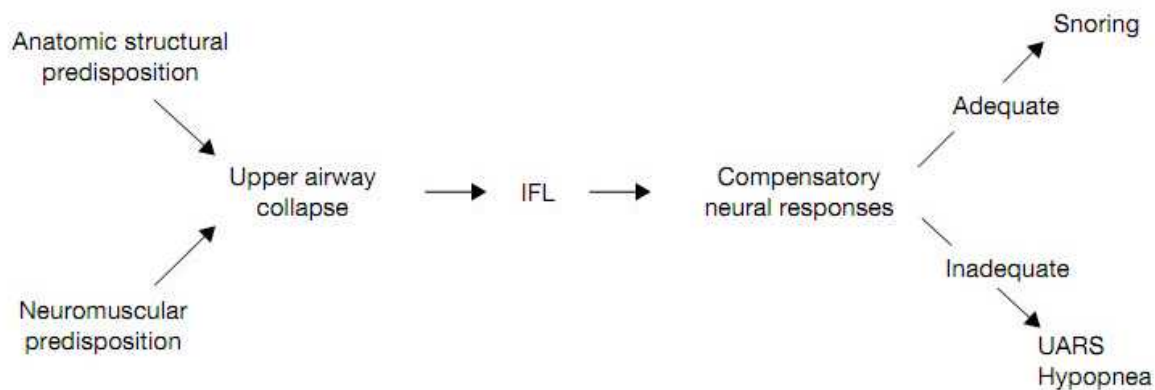
**Jason et al** mentioned that snoring was caused by upper air way obstruction and there may be increased propensity of the upper airway to collapse during sleep due to loss of neuromuscular tone<sup>11</sup>.

**Caples et al, Duran et al, Young et al,** have concluded that snoring and obstructive sleep apnea syndrome are two highly prevalent sleep disorders caused by collapse of the upper airways<sup>7</sup>.

**Young et al** proposed that risk factors such as obesity, male sex, age and heritable factors have been associated with increased chance for the development of obstructive sleep apnea in general population<sup>35</sup>.

**Mayer et al** evaluated 140 snorers with or without obstructive sleep apnea. The subjects underwent Polysomnography, Cephalometry and Upper Airway Computed Tomography. They have concluded that subjects with obstructive sleep apnea had more upper airway abnormalities and also suggested that shape of the pharyngeal lumen depends upon the body mass index<sup>22</sup>.

**Jason et al** proposed the pathogenesis of snoring and upper air way resistance syndrome as below <sup>13</sup>-



## 2.4 COMPLICATIONS OF SNORING

**American academy of sleep medicine, Marin et al**, Obstructive sleep apnea was a significant public health problem and was associated with sleep fragmentation, day time hyper somnolence and increased cardiovascular risk<sup>1</sup>.

**Schellenberg et al** has mentioned that persons with short and fat neck had more chance for snoring<sup>28</sup>.

**Newman et al** pointed out that snoring is a common phenomenon and associated with obstructive sleep apnea syndrome which may be a risk factor for cardiovascular disease<sup>25, 21</sup>. **Lugaresi et al** theorized that prolonged snoring over years may lead to obstructive sleep apnea<sup>20</sup>.

**Jennifer** conducted a study in United Kingdom among snorers. She concluded that couples who struggled with snoring have more chance for broken marriages<sup>14</sup>.

**Tilkian et al**, they did a study in 22 subjects with obstructive sleep apnea and they found that there was high prevalence for pulmonary hypertension<sup>31</sup>.



**G.Berger et al** performed a retrospective analysis on 160 untreated patients with primary snoring and mild, moderate or severe obstructive sleep apnea over 3 years. They have concluded that there was an increase in apnea – hypopnea index over time because of weight gain and to a lesser extent, on time<sup>9</sup>.

## **2.5 ASSESSMENT TOOLS**

### **2.5.1 EPWORTH DAY TIME SLEEPINESS SCALE**

**Bloch et al**, they have administered Epworth sleepiness scale to 159 German speaking people with sleep disorders. They concluded that it was simple and reliable to assess day time sleepiness<sup>3</sup>.

**Johns** administered 8 item questionnaires to 87 healthy medical students and 54 obstructive sleep apnea patients. He readministered the same at 5 and 9 months respectively. The result showed no change in healthy subjects and change in sleep apnea because of the usage of continuous positive airway pressure. So he concluded the scale as a simple and reliable tool<sup>16</sup>.

### **2.5.2 PITTSBURGH SLEEP QUALITY INDEX**

**Tamar et al**, Pittsburgh sleep quality index Hebrew version was administered to 61 non clinical healthy adults and to 450 patients in a sleep clinic. Pittsburgh sleep quality index differentiated clinical and non healthy samples. The results showed adequate validity and reliability<sup>30</sup>.

**Buysse et al** assessed Pittsburgh sleep quality index on 54 good sleepers, 54 bad sleepers and 62 sleep disorder patients over 18 months. The global score helped to conclude as a self rated questionnaire to assess sleep quality. It has 7 components and its global sum conveys it as a simple and reliable assessment tool<sup>6</sup>.

### **2.5.3 BERLIN QUESTIONNAIRE**

**Netzer et al** were conducted a survey in 1008 adults. He explained about the domains in the Berlin questionnaire which helped him to find out the risk level of the subjects. Thus he concluded that the Berlin questionnaire is a validated tool to determine snoring behavior, wake time sleepiness or fatigue and the presence of obesity or hypertension<sup>24</sup>.

**Sharma et al** conducted a cross sectional study in which he was administered Berlin questionnaire in 180 middle aged adults, of whom, 104 underwent overnight polysomnography. Questionnaire addressed

the frequency of snoring, wake time sleepiness, fatigue, obesity and hypertension .The findings suggested that administration of questionnaire prior to polysomnography helps to identify high risk patients<sup>27</sup> .

#### **2.5.4 NECK CIRCUMFERENCE**

**Vasudev et al** conducted a study in 104 middle aged adults for the purpose of screening. They had taken neck circumference because it is a contributory factor for sleep disorders. The measurement was taken at the level of cricothyroid membrane using a non –elastic measuring tape<sup>32</sup> .

**David et al** did a case series study in 3,942 obstructive sleep apnea patients (2,753 men and 1,189 women). Neck circumference was measured to identify upper air way obesity. The results concluded that men had larger neck circumference and frequency of sleep apnea symptoms were greater in men than in women<sup>8</sup> .

#### **2.6 OROPHARYNGEAL EXERCISE**

**Guimaraes et al** did a randomized controlled trial in 31 obstructive sleep apnea syndrome patients. 15 patients were in control group and 16 in experimental group. Experimental subjects received oropharyngeal exercises for 3 months of daily 30 minutes. They have concluded that these exercises help to reduce snoring frequency and intensity and improve sleep quality and also help to reduce day time sleepiness<sup>10,18</sup> .

**Milo et al**, they have done a randomized controlled study in snoring and sleep apnea subjects. They instructed them to practice didgeridoo playing for 4 months. The results concluded that there was significant improvement in day time sleepiness, sleep quality and in health related quality of life<sup>23</sup> .

**Winfried et al** conducted a randomized controlled trial in 67 patients with obstructive sleep apnea.34 patients in the experimental group were treated by tongue training program twice a day daily at day time for 8 months. Placebo treatment was given to the control group. The results concluded that snoring of experimental group subjects was reduced<sup>33</sup> .

**Bailey et al** described a new method of upper airway exercise training. The series of exercise consists of sucking, swallowing, chewing, breathing and speech and this was developed to increase upper air way patency<sup>2</sup> .

**Guimaraes et al**, made a study in sleep disordered patients with phonoaudiology. The results concluded that it will help to improve the tone of upper airway muscles<sup>10</sup> .

## **2.7 LIFE STYLE MODIFICATIONS**

**John et al**, recommended exercises, weight loss, avoidance of beverages before sleep etc to reduce snoring<sup>15</sup>.

**Mayo clinic** suggested life style changes, lose weight, sleep on side, quit smoking and alcohol ,avoid sleeping pills etc as the measures to reduce snoring<sup>34</sup>.

## **2.8 SUMMARY**

Based on the evidence it is proved that snorers are in risk to develop sleep apnea and also proved the effect of oropharyngeal exercises in obstructive sleep apnea patients by reducing the snoring characteristics. So it can be safely administered to the habitual snorers for preventing the progression of the disease and its associated complications. Awareness of the condition educates, encourages, equips and empowers the subjects to lead happy and healthy life.

## **AIM AND OBJECTIVES**

## **3. AIM AND OBJECTIVES**

### **3.1 AIM OF THE STUDY**

To study the effect of oropharyngeal exercises on snorers.

### **3.2 OBJECTIVES OF THE STUDY**

- To study the effect of oropharyngeal exercises on day time sleepiness.
- To study the effect of oropharyngeal exercises on sleep quality.
- To study the effect of oropharyngeal exercises on snoring frequency and intensity.
- To study the effect of oropharyngeal exercises on neck circumference

**MATERIALS AND**  
**METHODOLOGY**

## **4. MATERIALS AND METHODOLOGY**

### **4.1. RESEARCH DESIGN**

Pretest and post test experimental study design.

### **4.2. STUDY SETTING**

Subject's home setting.

### **4.3. SAMPLE SIZE**

30 Snorers.

### **4.4. SAMPLING TECHNIQUE**

Purposive sampling.

### **4.5. CRITERIA FOR SELECTION**

#### INCLUSION CRITERIA

- Age-25 to 45 years
- Sex-both male& female
- Snoring Frequency -Berlin Questionnaire score of 1to 4

#### EXCLUSION CRITERIA

- Presence of craniofacial abnormalities
- Regular use of hypnotic medicines
- Neuromuscular disease
- Recent nasal infections

## **4.6. HYPOTHESIS**

### **4.6.1 NULL HYPOTHESIS:**

H<sub>01</sub> -There is no significant effect of oropharyngeal exercises on day time sleepiness.

H<sub>02</sub> - There is no significant effect of oropharyngeal exercises on sleep quality.

H<sub>03</sub> . There is no significant effect of oropharyngeal exercises on snoring frequency and intensity.

H<sub>04</sub> - There is no significant effect of oropharyngeal exercises on neck circumference

### **4.6.2 ALTERNATE HYPOTHESIS:**

H<sub>A1</sub> - There is significant effect of oropharyngeal exercises on day time sleepiness.

H<sub>A2</sub> - There is significant effect of oropharyngeal exercises on sleep quality.

H<sub>A3</sub> - There is significant effect of oropharyngeal exercises on snoring frequency and intensity.

H<sub>A4</sub> - There is significant effect of oropharyngeal exercises on neck circumference .

## **4.7. STUDY METHOD**

The subjects are divided into 2 groups: Group A and Group B

### **Group A (oropharyngeal exercise group)**

Oropharyngeal exercises 30 minutes daily for 6 weeks along with life style modifications.

### **Group B (control group)**

Life style modifications alone.



## **4.8. PROCEDURE**

The subjects who satisfy with the inclusion criteria are taken for the study and get the informed consent. Then they are randomly allocated either in the experimental or in control group. The explanation about the condition is given to the subjects. Pre test assessment is taken for the subject. Life style modifications are suggested to the subjects in the Group B. Group A subjects are treated with oropharyngeal exercises by direct demonstration and with the help of audio- visual aids along with life style modifications .Subjects are given hand –outs and copies of compact disc with the guidelines to perform the exercise in the house. Subject is encouraged and motivated to do the exercises regularly by calling up every week. After 6 weeks Post test assessment is taken.

The subject is given the following instructions:

### **OROPHARYNGEAL EXERCISES- GROUP A**

#### **A: TONGUE EXERCISES**

The subject is asked to stand in front of the mirror:

- ✓ To brush the upper and either sides of his tongue gently, all the while the tongue should be positioned in the floor of the mouth .( 3 minutes)
- ✓ To place the tip of his tongue against the front part of the roof of his mouth and gently slides the tongue backward and forwards.(3 minutes)
- ✓ To suck his tongue upward forcefully against the front part of the roof of his mouth and press the entire tongue against the same part .(3 minutes)
  
- ✓ Take 1 minute rest after each exercise

#### **B: FACIAL EXERCISES**

The subject is instructed to stand in front of the mirror:

- ✓ To close his mouth tightly with the lips for 30 seconds and relax .(3 minutes)
- ✓ To suck the air inside his mouth using cheek muscles .(3 minutes)
- ✓ To raise his cheek alternatively on either side intermittently with the lips. (3 minutes).
- ✓ Take 1 minute rest after each exercise.

#### 4.8.1 PHOTOGRAPHIC ILLUSTRATION



## **C: FUNCTIONAL EXERCISES**

The subject is instructed to sit straight in a chair and do the following:

- ✓ To breath in forcefully through the nose and breath out through the mouth by producing sounds like Aaa, Ooo ,Eee etc (3 min) .
- ✓ To breath in through the nose, while breath out forcefully blow the balloon.(3 min) .
- ✓ To alternately chew and swallow using the tongue in the roof of the mouth, whenever feeding. (Atleast 7 min).
- ✓ Take 1 minute rest after each exercise.

Duration- 30 minutes daily for 6weeks.

## **LIFE STYLE MODIFICATIONS -GROUP A and B**

The subject is instructed to:

- Quit Smoking
- Abstain from alcohol
- Reduce weight
- Adapting side lying position while asleep.

## **4.9. OUTCOME MEASURES AND MEASUREMENT TOOLS**

- Day time sleepiness is measured by using Epworth day time sleepiness scale.
- Sleep quality is measured with the help of Pittsburgh sleep quality index.
- Snoring frequency and intensity are measured by using Berlin questionnaire.
- Neck circumference is measured with the help of Inch tape.

#### 4.10. STATISTICAL TOOL

Pre test and Post test values of the study will be collected and assessed for variation in the improvement and their results will be analyzed using Independent 't' test and Paired 't' test.

INDEPENDENT 't' TEST (between groups)

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S} \sqrt{\frac{n_1 n_2}{(n_1 + n_2)}}$$

Where,

$$S = \sqrt{\frac{\sum d_1^2 + \sum d_2^2}{n_1 + n_2 - 2}}$$

PAIRED 't' TEST (within groups)

$$t = \frac{\bar{d} \sqrt{n}}{S} \text{ Where,}$$

$$S = \sqrt{\frac{\sum d^2 - [\bar{d}]^2 \times n}{n - 1}}$$

S=combined standard deviation

$d_1$  &  $d_2$  =difference between initial & final readings in group A & group B respectively.

$n_1$  &  $n_2$  =number of patients in group A & group B respectively.

$\bar{X}_1$  &  $\bar{X}_2$  =Mean of group A & group B respectively.

Level of significance: 5%.

# **DATA PRESENTATION**

## 5. DATA PRESENTATION

### 5.1. TABULAR PRESENTATION

#### ➤ DAY TIME SLEEPINESS

**Table 5.1.1 INDEPENDENT ‘t’ TEST**

	PRE TEST		POST TEST	
	GROUP A	GROUP B	GROUP A	GROUP B
MEAN	5.800	7.083	4.700	6.500
Calculated ‘t’ value	1.850		3.007	
p value and Level of significance	p > 0.05 and not significant		p < 0.05 and significant	

**Table 5.1.2 PAIRED ‘t’ TEST**

	GROUP A		GROUP B	
	PRE TEST	POST TEST	PRE TEST	POST TEST
MEAN	5.800	4.700	7.083	6.500
Calculated ‘t’ value	11.000		3.924	
p value and Level of significance	p < 0.05 and significant		p < 0.05 and significant	

➤ **SLEEP QUALITY**

**Table 5.1.3 INDEPENDENT ‘t’ TEST**

	PRE TEST		POST TEST	
	GROUP A	GROUP B	GROUP A	GROUP B
MEAN	4.600	5.083	3.700	4.750
Calculated ‘t’ value	1.003		2.895	
p value and Level of significance	p > 0.05 and not significant		p < 0.05 and significant	

**Table 5.1.4 PAIRED ‘t’ TEST**

	GROUP A		GROUP B	
	PRE TEST	POST TEST	PRE TEST	POST TEST
MEAN	4.600	3.700	5.083	4.750
Calculated ‘t’ value	5.014		2.345	
p value and Level of significance	p < 0.05 and significant		p < 0.05 and significant	

➤ **SNORING FREQUENCY**

**Table 5.1.5 INDEPENDENT 't' TEST**

	PRE TEST		POST TEST	
	GROUP A	GROUP B	GROUP A	GROUP B
MEAN	2.900	3.083	1.800	2.750
Calculated 't' value	0.410		2.882	
p value and Level of significance	p > 0.05 and not significant		p < 0.05 and significant	

**Table 5.1.6 PAIRED 't' TEST**

	GROUP A		GROUP B	
	PRE TEST	POST TEST	PRE TEST	POST TEST
MEAN	2.900	1.800	3.083	2.750
Calculated 't' value	4.714		2.345	
p value and Level of significance	p < 0.05 and significant		p < 0.05 and significant	



➤ **SNORING INTENSITY**

**Table 5.1.7 INDEPENDENT‘t’ TEST**

	PRE TEST		POST TEST	
	GROUP A	GROUP B	GROUP A	GROUP B
MEAN	1.900	2.083	1.300	1.916
Calculated ‘t’ value	0.557		2.432	
p value and Level of significance	p > 0.05 and not significant		p < 0.05 and significant	

**Table 5.1.8 PAIRED‘t’ TEST**

	GROUP A		GROUP B	
	PRE TEST	POST TEST	PRE TEST	POST TEST
MEAN	1.900	1.300	2.083	1.916
Calculated ‘t’ value	3.674		1.483	
p value and Level of significance	p < 0.05 and significant		p > 0.05 and not significant	

➤ **NECK CIRCUMFERENCE:**

**Table 5.1.9 INDEPENDENT 't' TEST**

	PRE TEST		POST TEST	
	GROUP A	GROUP B	GROUP A	GROUP B
MEAN	35.200	35.083	35.110	35.058
Calculated 't' value	0.168		0.073	
p value and Level of significance	p > 0.05 and not significant		p > 0.05 and not significant	

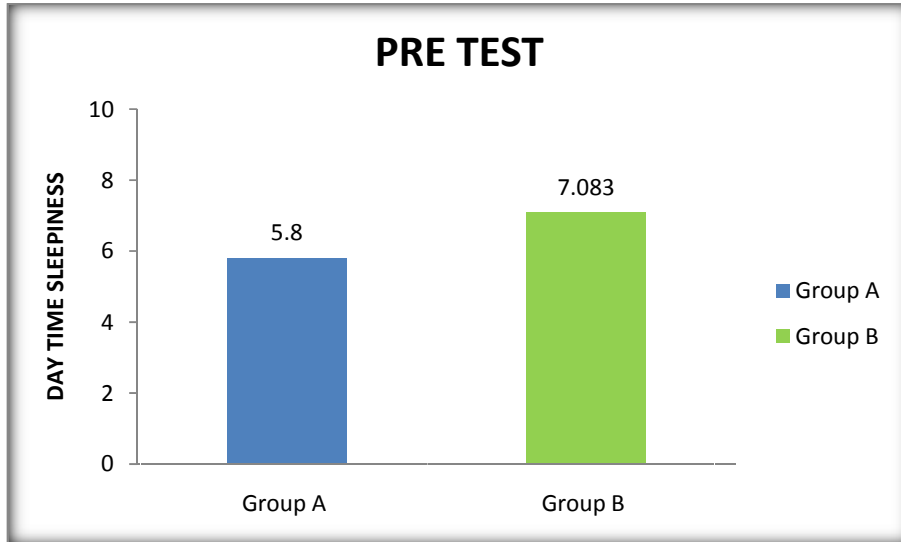
**Table 5.1.10 PAIRED 't' TEST**

	GROUP A		GROUP B	
	PRE TEST	POST TEST	PRE TEST	POST TEST
MEAN	35.200	35.110	35.0833	35.058
Calculated 't' value	2.586		1.393	
p value and Level of significance	p < 0.05 and significant		p > 0.05 and not significant	

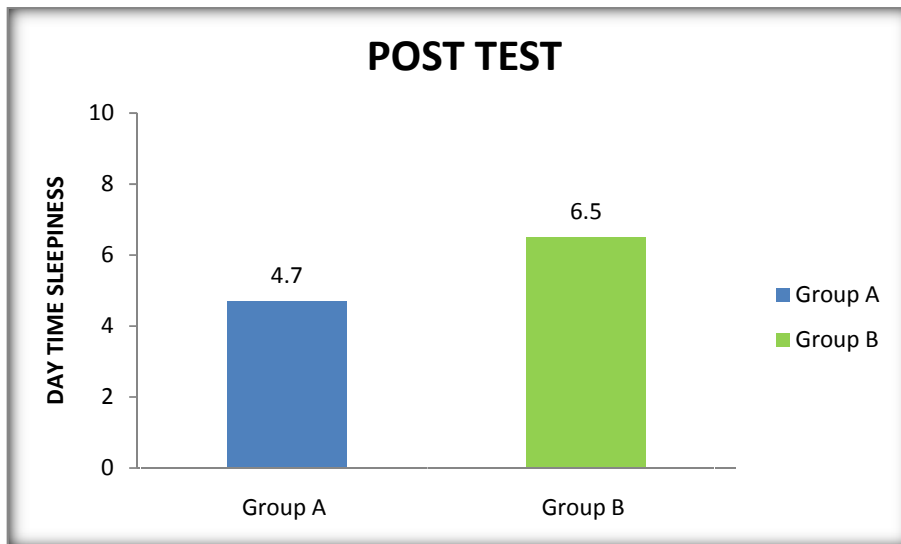
## 5.2 GRAPHICAL PRESENTATION

### EPWORTH DAY TIME SLEEPINESS SCALE

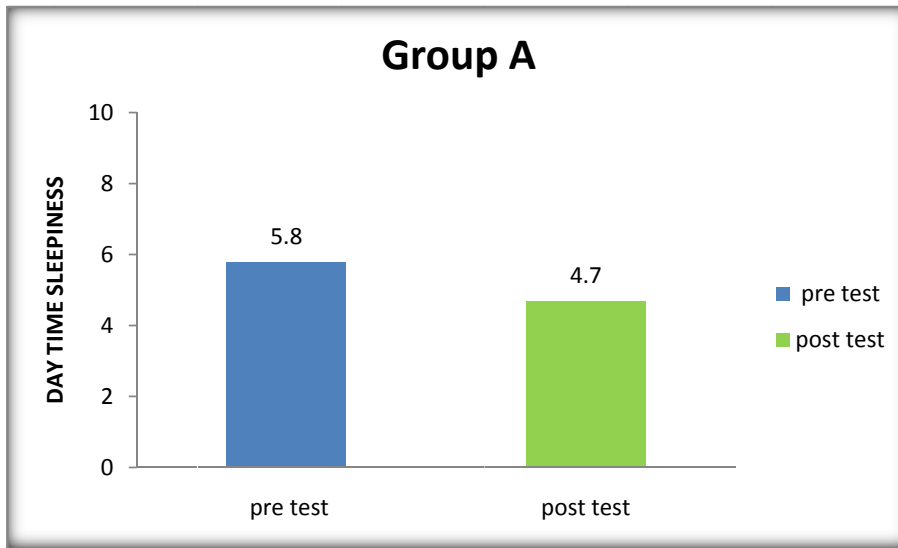
#### 5.2.1 GROUP A Vs GROUP B



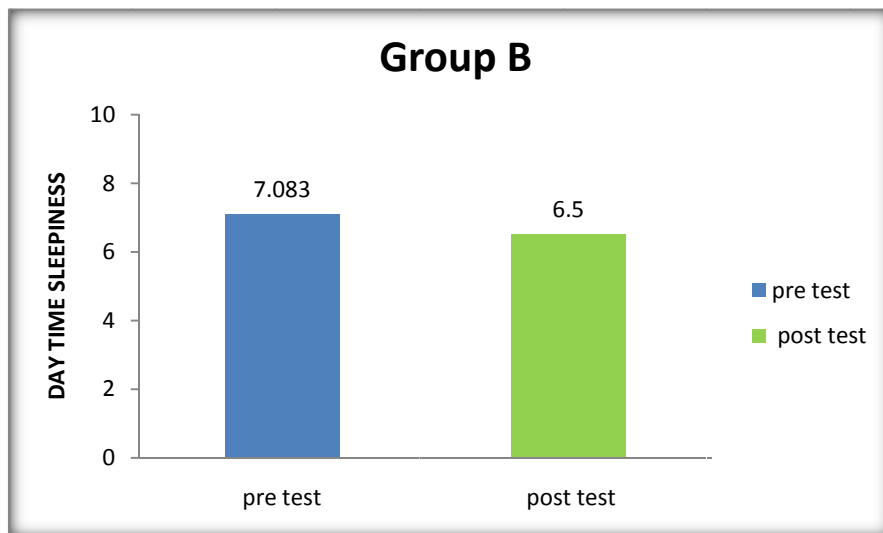
#### 5.2.2



### 5.2.3 PRE TEST Vs POST TEST

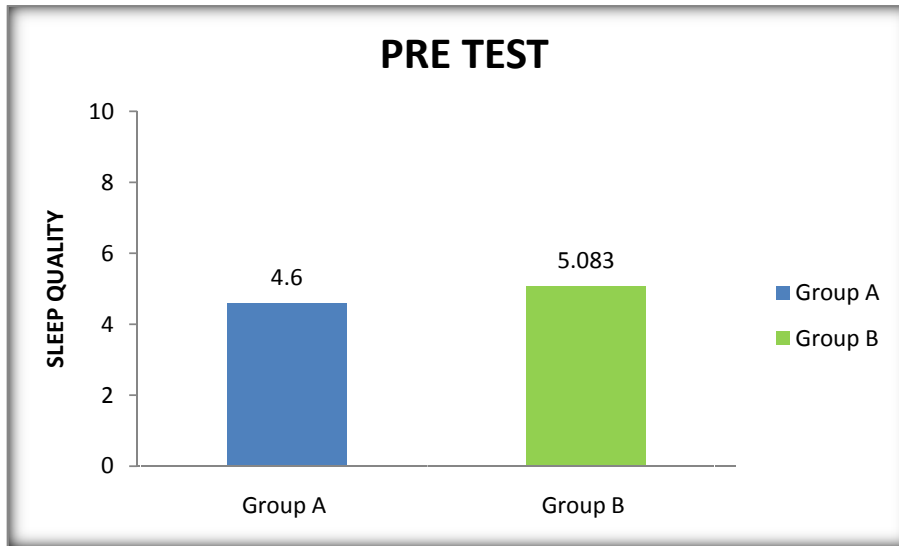


### 5.2.4

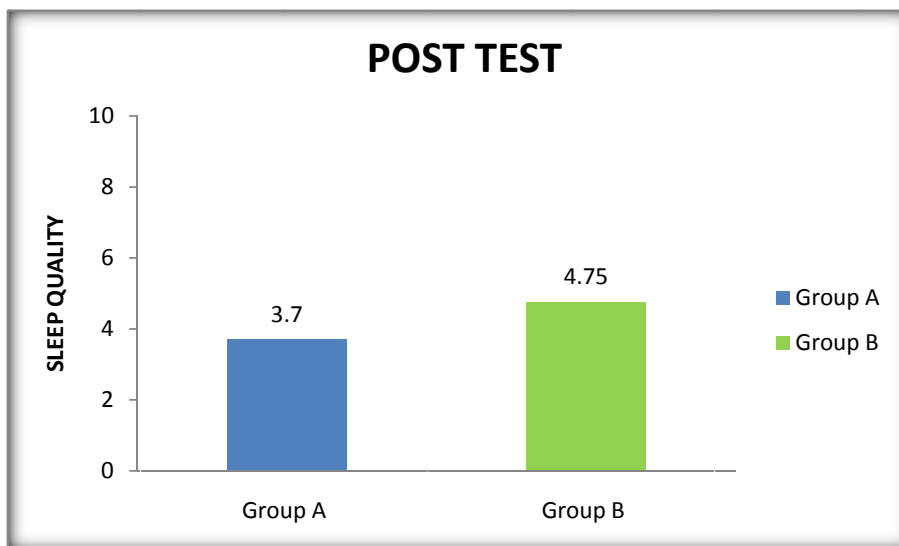


## PITTSBURGH SLEEP QUALITY INDEX:

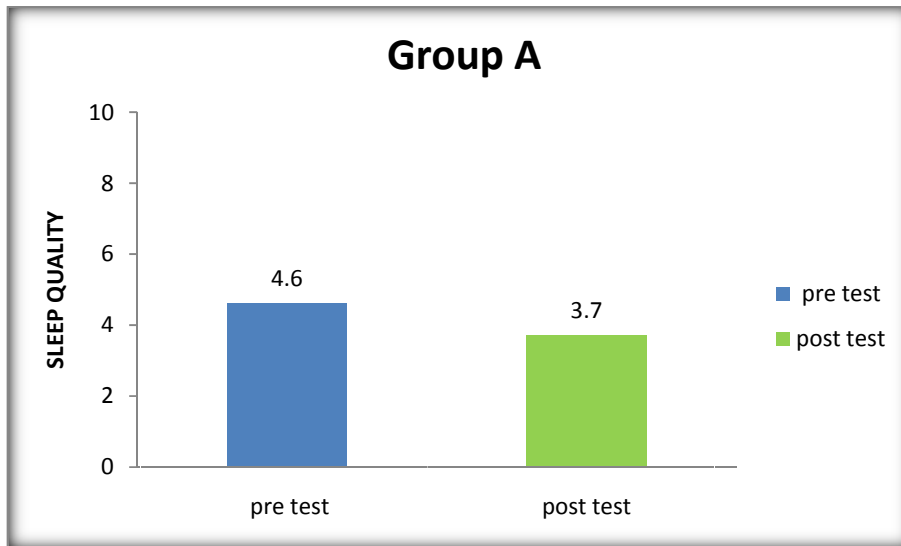
### 5.2.5 GROUP A Vs GROUP B



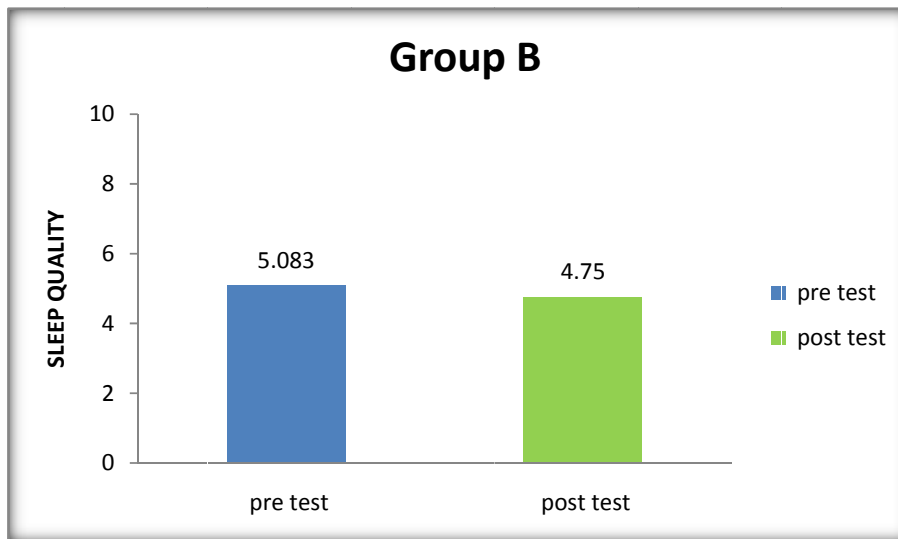
### 5.2.6



### 5.2.7 PRE TEST Vs POST TEST

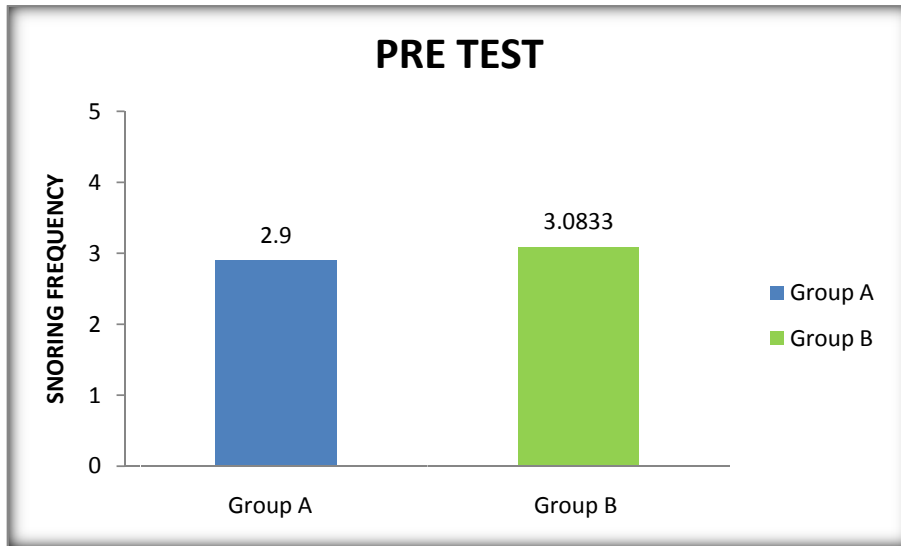


### 5.2.8

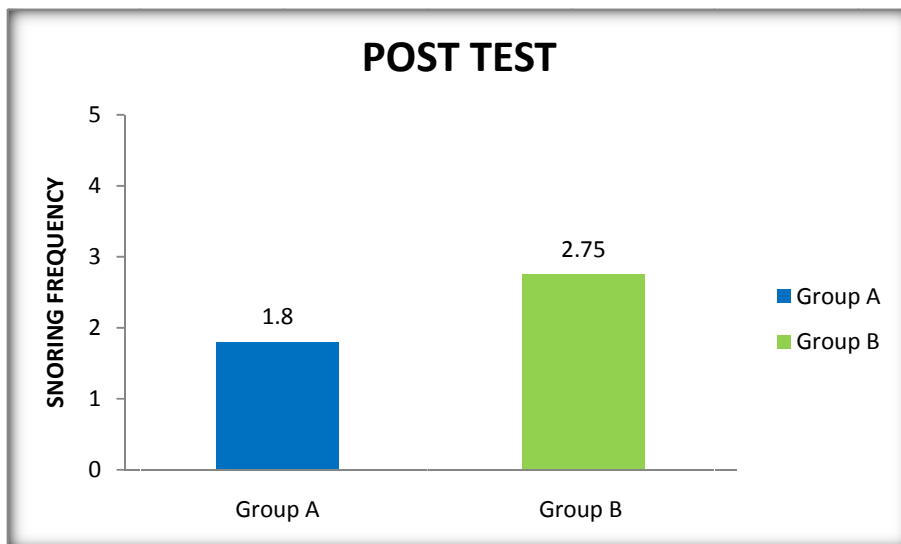


# BERLIN QUESTIONNAIRE

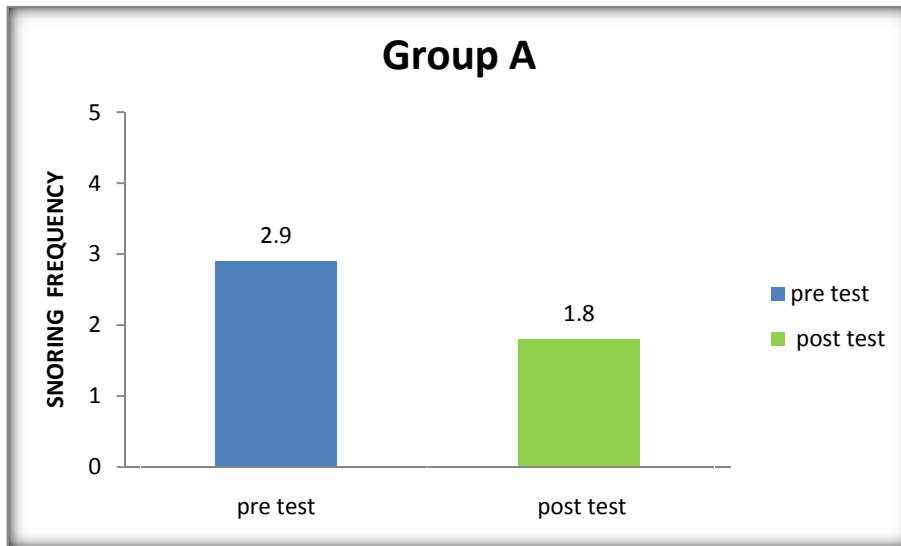
## 5.2.9 GROUP A Vs GROUP B



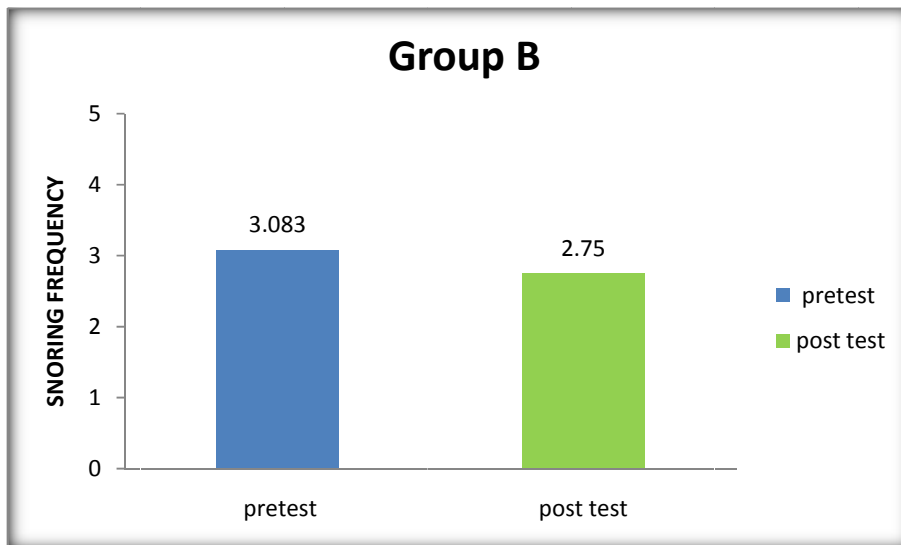
## 5.2.10



### 5.2.11 PRE TEST Vs POST TEST

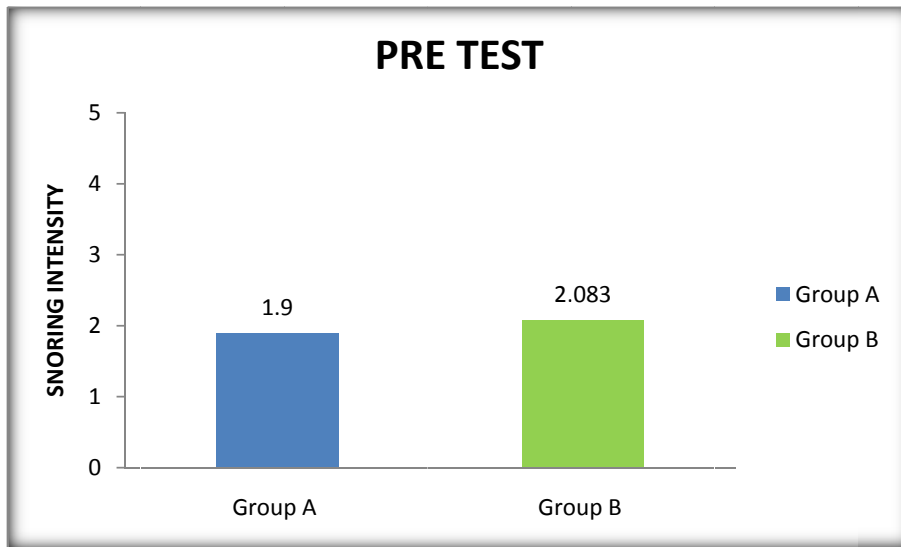


### 5.2.12

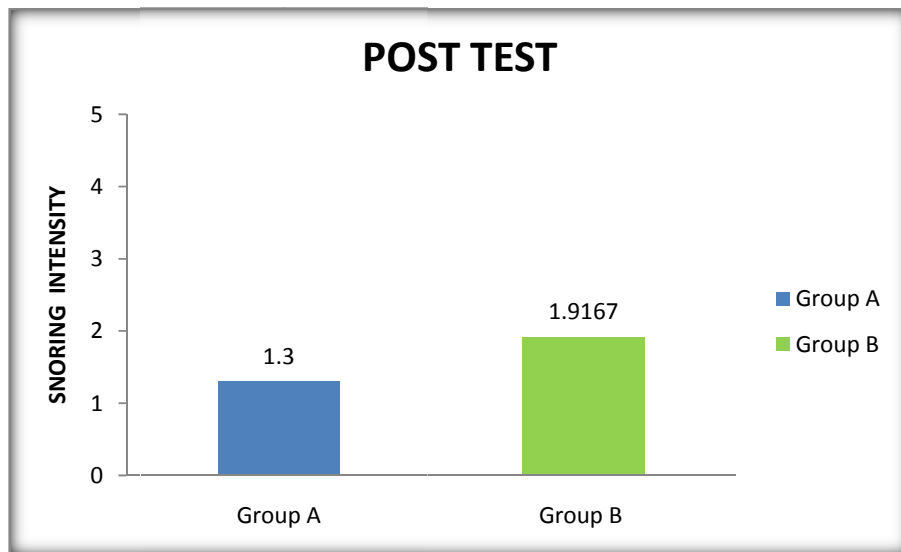




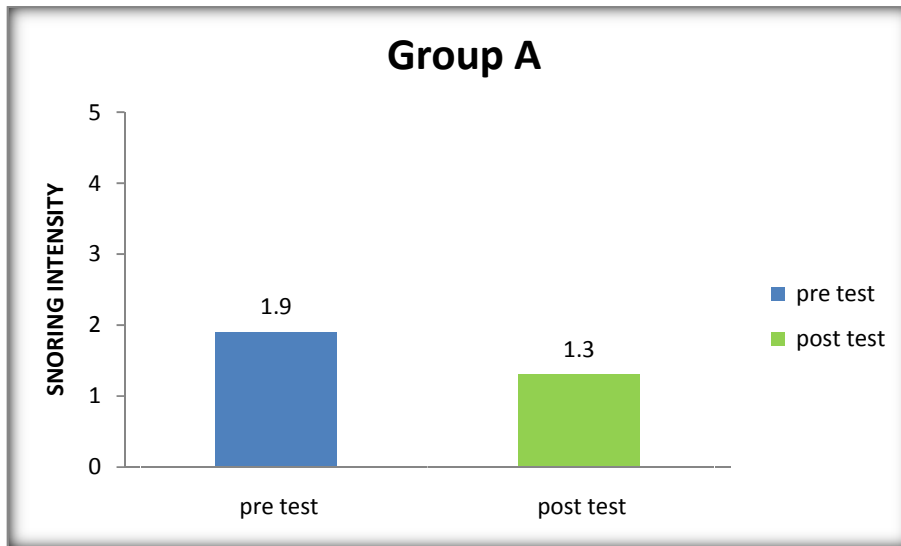
### 5.2.13 GROUP A Vs GROUP B



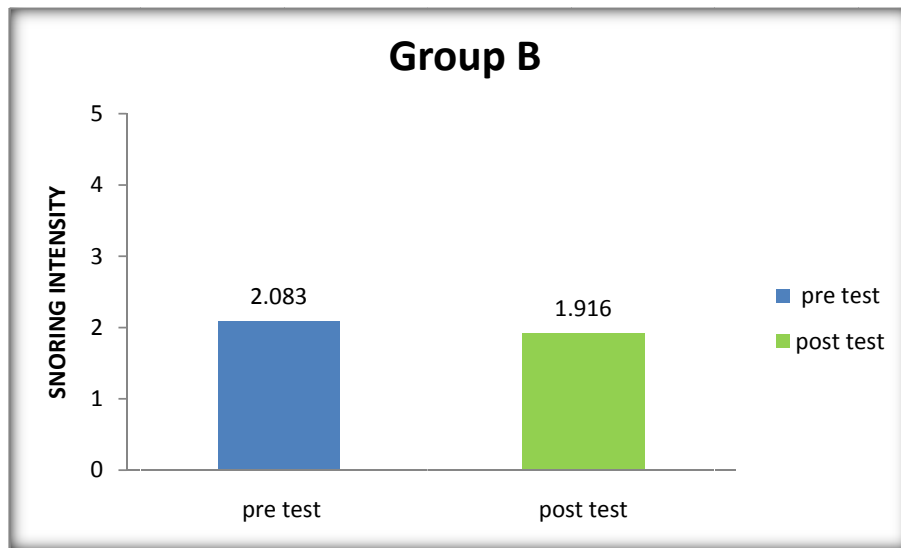
### 5.2.14



### 5.2.15 PRE TEST Vs POST TEST

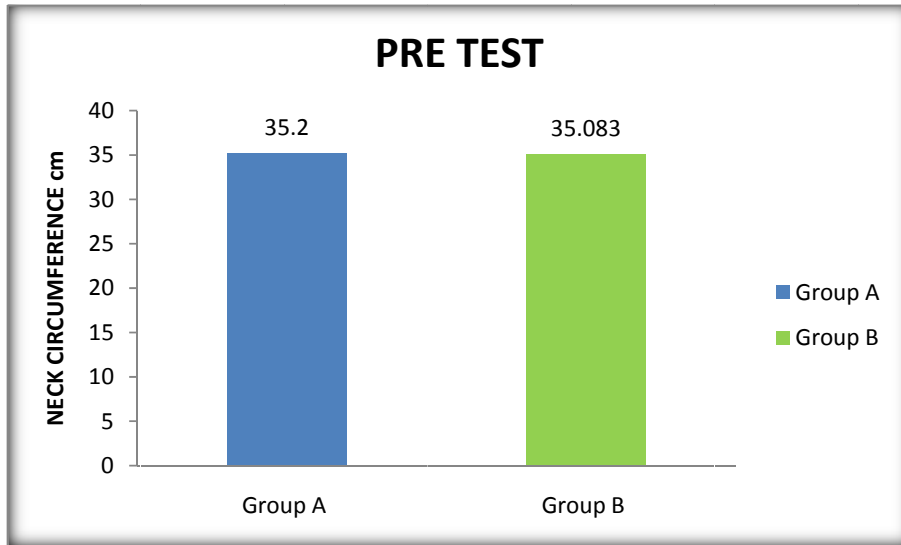


### 5.2.16

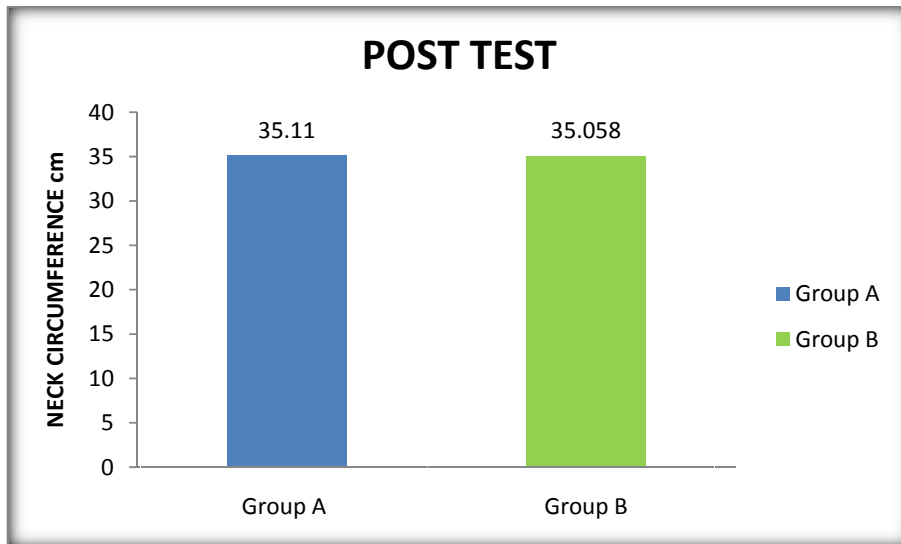


# NECK CIRCUMFERENCE

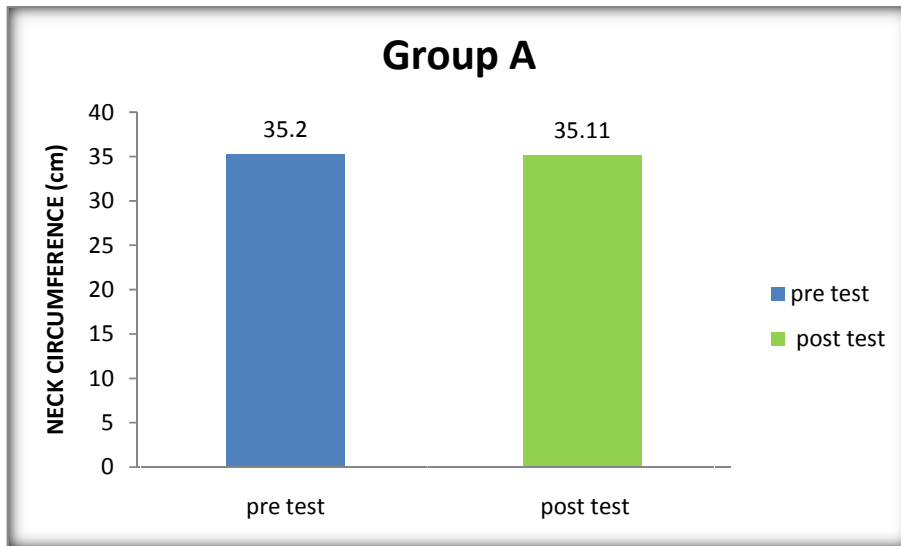
## 5.2.17 GROUP A Vs GROUP B



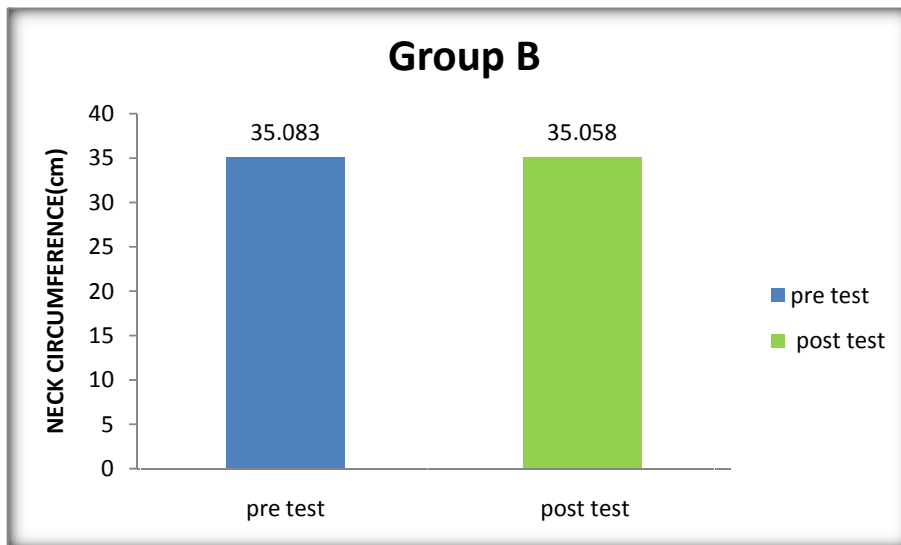
## 5.2.18



### 5.2.19 PRE TEST Vs POST TEST



### 5.2.20



# **DATA ANALYSIS AND** **INTERPRETATION**

## **6. DATA ANALYSIS AND INTERPRETATION**

### **➤ 6.1 EPWORTH DAY TIME SLEEPINESS SCALE:**

#### **PRE TEST VALUES:**

- The pre test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 1.850. As the calculated 't' value was lesser than the table 't' value, there was no significant difference between the pre test values of both groups. Hence there was homogeneity between both the groups before the intervention.

#### **POST TEST VALUES:**

- The post test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 3.007. As the calculated 't' value was greater than the table 't' value, null hypothesis is rejected. Hence there is significant difference between the oropharyngeal exercise group and lifestyle modification group.

#### **GROUP A- OROPHARYNGEAL EXERCISE GROUP:**

- The pre test and post test values of Epworth day time sleepiness scale was analysed using Paired 't' test. For 9 degrees of freedom and at 5% level of significance, the table 't' value is 2.262 and the calculated 't' value was 11.000. As the calculated 't' value was greater than the table 't' value, null hypothesis was rejected. Hence there was significant effect of oropharyngeal exercises on day time sleepiness.

#### **GROUP B – LIFE STYLE MODIFICATION GROUP:**

- The pre test and post test values of Epworth day time sleepiness was analysed using paired 't' test. For 11 degrees of freedom and at 5% level of significance, the table 't' value is 2.201 and the calculated 't' value was 3.924. As the calculated 't' value was greater than the table 't' value, null hypothesis was rejected. Hence there was significant effect of life style modifications on day time sleepiness.

## ➤ 6.2 PITTSBURGH SLEEP QUALITY SCALE:

### PRE TEST VALUES:

- The pre test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 1.003. As the calculated 't' value was lesser than the table 't' value; there was no significant difference between the pre test values of both groups. Hence there was homogeneity between both the groups before the intervention.

### POST TEST VALUES:

- The post test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 2.895. As the calculated 't' value was greater than the table 't' value, null hypothesis is rejected. Hence there is significant difference between the oropharyngeal exercise group and lifestyle modification group.

### GROUP A- OROPHARYNGEAL EXERCISE GROUP:

- The pre test and post test values of Pittsburgh sleep quality index was analysed using Paired 't' test. For 9 degrees of freedom and at 5% level of significance, the table 't' value is 2.262 and the calculated 't' value was 5.014. As the calculated 't' value was greater than the table 't' value, null hypothesis was rejected. Hence there was significant effect of oropharyngeal exercises on sleep quality.

### GROUP B – LIFE STYLE MODIFICATION GROUP:

- The pre test and post test values of Pittsburgh sleep quality index was analysed using Paired 't' test. For 11 degrees of freedom and at 5% level of significance, the table 't' value is 2.201 and the calculated 't' value was 2.345. As the calculated 't' value was greater than the table 't' value, null hypothesis was rejected. Hence there was significant effect of life style modifications on sleep quality.

## ➤ 6.3 BERLIN QUESTIONNAIRE:

### 6.3.1 SNORING FREQUENCY

#### PRE TEST VALUES:

- The pre test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 0.410. As the calculated 't' value was lesser than the table 't' value; there was no significant difference between the pre test values of both groups. Hence there was homogeneity between both the groups before the intervention.

#### POST TEST VALUES:

- The post test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 2.882. As the calculated 't' value was greater than the table 't' value, null hypothesis is rejected. Hence there is significant difference between the oropharyngeal exercise group and lifestyle modification group.

#### GROUP A- OROPHARYNGEAL EXERCISE GROUP:

- The pre test and post test values of Snoring frequency was analysed using Paired 't' test. For 9 degrees of freedom and at 5% level of significance, the table 't' value is 2.262 and the calculated 't' value was 4.714. As the calculated 't' value was greater than the table 't' value, null hypothesis was rejected. Hence there was significant effect of oropharyngeal exercises on snoring frequency.

#### GROUP B – LIFE STYLE MODIFICATION GROUP:

- The pre test and post test values of was Snoring frequency was analysed using Paired 't' test. For 11 degrees of freedom and at 5% level of significance, the table 't' value is 2.201 and the calculated 't' value was 2.345. As the calculated 't' value was greater than the table 't' value, null hypothesis was rejected. Hence there was significant effect of life style modifications on snoring frequency.



### **6.3.2 SNORING INTENSITY**

#### **PRE TEST VALUES:**

- The pre test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 0.557. As the calculated 't' value was lesser than the table 't' value; there was no significant difference between the pre test values of both groups. Hence there was homogeneity between both the groups before the intervention.

#### **POST TEST VALUES:**

- The post test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 2.432. As the calculated 't' value was greater than the table 't' value, null hypothesis is rejected. Hence there is significant difference between the oropharyngeal exercise group and lifestyle modification group.

#### **GROUP A- OROPHARYNGEAL EXERCISE GROUP:**

- The pre test and post test values of Snoring intensity was analysed using Paired 't' test. For 9 degrees of freedom and at 5% level of significance, the table 't' value is 2.262 and the calculated 't' value was 3.674. As the calculated 't' value was greater than the table 't' value, null hypothesis was rejected. Hence there was significant effect of oropharyngeal exercises on snoring intensity.

#### **GROUP B – LIFE STYLE MODIFICATION GROUP:**

- The pre test and post test values of was Snoring intensity was analysed using Paired 't' test. For 11 degrees of freedom and at 5% level of significance, the table 't' value is 2.201 and the calculated 't' value was 1.483. As the calculated 't' value was lesser than the table 't' value, null hypothesis was accepted. Hence there was no significant effect of life style modifications on snoring intensity

## ➤ 6.4 NECK CIRCUMFERENCE:

### **PRE TEST VALUES:**

- The pre test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 0.168. As the calculated 't' value was lesser than the table 't' value; there was no significant difference between the pre test values of both groups. Hence there was homogeneity between both the groups before the intervention.

### **POST TEST VALUES:**

- The post test values of both the groups were analysed using independent 't' test. For 20 degrees of freedom and 5% level of significance, the table 't' value is 2.086 and the calculated 't' value is 0.073. As the calculated 't' value was lesser than the table 't' value, null hypothesis is accepted. Hence there is no significant difference between the oropharyngeal exercise group and lifestyle modification group.

### **GROUP A- OROPHARYNGEAL EXERCISE GROUP:**

- The pre test and post test values of Neck circumference was analysed using Paired 't' test. For 9 degrees of freedom and at 5% level of significance, the table 't' value is 2.262 and the calculated 't' value was 2.586. As the calculated 't' value was greater than the table 't' value, null hypothesis was rejected. Hence there was significant effect of oropharyngeal exercises on neck circumference.

### **GROUP B – LIFE STYLE MODIFICATION GROUP:**

- The pre test and post test values of Neck circumference was analysed using Paired 't' test. For 11 degrees of freedom and at 5% level of significance, the table 't' value is 2.201 and the calculated 't' value was 1.393. As the calculated 't' value was lesser than the table 't' value, null hypothesis was accepted. Hence there was no significant effect of life style modifications on neck circumference.

## **DISCUSSION**

## 7. DISCUSSION

The proportions of snorers are increasing due to its associated risk factors. It is time to consider snoring as a medical condition and to prevent its associated complications.

The study was conducted to investigate the effects of upper airway muscle training by a series of oropharyngeal exercises in patients with snoring.

In this study, after getting the informed consent, 30 subjects were taken and randomly allocated to 15 in Group A and others in Group B according to the inclusion criteria of which 5 from experimental and 3 from control group were withdrawn from the study due to their personal inconvenience. Thirty minutes daily exercises along with life style modifications were administered to Group A subjects and life style modifications alone were suggested to group B subjects. Pre test and Post test assessment were taken on the basis of 5 outcome measures with the help of 4 measurement tools as follows. Day time sleepiness was measured using the Epworth sleepiness scale, Sleep quality by the Pittsburgh sleep quality index, Snoring frequency and intensity with the help of the Berlin questionnaire and neck circumference with the help of inch tape. Data were statistically analysed by using independent and Paired't' test.

Pre test measurements showed homogeneity between the groups. Post test measurement showed a significant difference between the groups in day time sleepiness, sleep quality and in snoring frequency and intensity; having no significant improvement in neck circumference between the groups.

In the Group B, where only life style modification was given, there was a significant difference in day time sleepiness, sleep quality and snoring frequency. When life style modification was followed, there is a shift in the tongue position from posterior to anterolateral while lying on the side. Also when smoking and alcohol were avoided, there was maintenance of tone of the oropharyngeal muscles. Hence the improvement in the control group can be attributed to the position change of the tongue and also maintaining the tone. Thus this had helped in reducing the snoring frequency and thereby improving sleep quality. This in turn reduced the day time sleepiness. Though statistically not significant, there was difference in the mean value of snoring intensity. Smaller duration was not enough to change the snoring intensity. Longer duration may be helpful to get statistical significance. Regarding neck circumference there was no significant difference in the Group B. Since life-style modification may need more time to reduce the neck circumference.

In the Group A, where life style modification and oropharyngeal exercises were given, there was a significant difference in day time sleepiness, sleep quality, snoring frequency, snoring intensity and neck circumference. Group A had a great benefit by the intervention when compared to Group B. Oropharyngeal exercises helped to recruit the upper airway muscles, tongue and facial muscles. This is achieved by improving the tone of the upper airway muscles thereby improving the patency of the air way. In addition,

these exercises also recruit muscle fibres of the palatopharyngeal and palatoglossus muscles. This helped to maintain the tongue posture. The facial muscles are also recruited during chewing, that promotes mandibular elevation, avoiding mouth opening. The moderate association between changes in neck circumference suggests that the exercises induce upper airway remodeling that in turn correlates with airway patency during sleep. This upper airway remodeling induces changes in neck circumference. This improved patency and tone of the oropharyngeal muscles helped to maintain the diameter of the airway, thereby reducing the snoring intensity and frequency. This in turn had helped to improve the sleep quality, thereby reducing day time sleepiness. In addition, partners of the participants in the oropharyngeal exercise group were much less disturbed in their sleep.

A study which was done in moderate obstructive sleep apnea showed that there was improvement in day time sleepiness, sleep quality, snoring frequency and intensity ,apnea- hypopnea index and in neck circumference .They concluded that the improvement was due to recruitment of upper air way muscles which helped to maintain the soft palate<sup>10</sup>.

Another study which was done in obstructive sleep apnea syndrome concluded that didgeridoo playing for 4 months helped to reduce day time sleepiness and the apnea- hypopnea index .This is because of the reduction in the collapsibility of the upper airways<sup>23</sup> .

Hence these results infer that oropharyngeal exercises are effective, compliant and a promising treatment in the reduction of snoring.

## **SUMMARY AND CONCLUSION**

## **8. SUMMARY AND CONCLUSION**

This study was conducted to analyse the effectiveness of oropharyngeal exercises on snorers. It was conducted in 2 groups. Group A received oropharyngeal exercises and life style modifications while Group B received life style modifications alone, which lasted for 6 weeks. Day time sleepiness, sleep quality, snoring frequency and intensity and neck circumference were noted before and after training.

The statistical analysis using Paired 't' test at 5% level of significance showed that there was significant improvement in day time sleepiness, sleep quality and snoring frequency within the groups. Snoring intensity and neck circumference were improved only in Group A. Also the statistical analysis using independent 't' test at 5% level of significance showed that there was significant difference in day time sleepiness, sleep quality, snoring frequency and intensity. Hence, it can be concluded that oropharyngeal exercises along with life style modifications have more effect on snoring and its associated features.

**LIMITATIONS AND**  
**SUGGESTIONS**



## **9. LIMITATIONS AND SUGGESTIONS**

Though carried out with the best of efforts, the study has the following limitations and suggestions as listed below:

- The sample size was small and studies with larger samples are recommended.
- Only the snorers were taken for the study and did not consider the duration of the problem. Further studies can be done in sleep apnea also.
- The treatment duration lasted for only 6 weeks. Further studies can be done with longer duration.
- Snoring frequency and intensity were measured subjectively .Polysomnography or voice recorder is recommended for the advanced studies.
- Home based exercise programme were without under supervision. Supervised programme is suggested for successive studies.

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## REFERENCES

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# **APPENDICES**

## **APPENDIX I**

### **INFORMED CONSENT TO PARTICIPATE IN THE RESEARCH STUDY**

I \_\_\_\_\_ voluntarily consent to participate in the research study

#### **“EFFECT OF OROPHARYNGEAL EXERCISES ON SNORERS”**

The researcher has explained me about the exercise approach in brief, the risk of participation and has answered the questions related to the research to my satisfaction

**Signature of the applicant:**

**Signature of the researcher:**

**Signature of the witness:**

## APPENDIX II

### Epworth Sleepiness Scale

Name:

Date:

Your age: (Yr) \_\_\_\_\_

Your sex: Male/Female

How likely are you to doze off or fall asleep in the situations described below, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently try to work out how they would have affected you.

Use the following scale to choose the most appropriate number for each situation:-

- 0 = would never doze
- 1 = Slight chance of dozing
- 2 = Moderate chance of dozing
- 3 = High chance of dozing

#### Situation

#### Chance of dozing

Sitting and reading .....	<input type="text"/>
Watching TV .....	<input type="text"/>
Sitting, inactive in a public place (e.g. a theatre or a meeting)..	<input type="text"/>
As a passenger in a car for an hour without a break .....	<input type="text"/>
Lying down to rest in the afternoon when circumstances permit...	<input type="text"/>
Sitting and talking to someone .....	<input type="text"/>
Sitting quietly after a lunch without alcohol .....	<input type="text"/>
In a car, while stopped for a few minutes in the traffic .....	<input type="text"/>
Total .....	<input type="text"/>

Score:

0-10 Normal range  
10-12 Borderlines  
12-24 Abnormal



## APPENDIX III

### The Pittsburgh Sleep Quality Index (PSQI)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions. During the past month,

1. When have you usually gone to bed? \_\_\_\_\_
2. How long (in minutes) has it taken you to fall asleep each night? \_\_\_\_\_
3. When have you usually gotten up in the morning? \_\_\_\_\_
4. How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed) \_\_\_\_\_

5. During the past month, how often have you had trouble sleeping because you...	Not during the past month(0)	Less than once a week(1)	Once or twice a week(2)	Three or more times week (3)
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe, including how often you have had trouble sleeping because of this reason(s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad
9. During the past month, how would you rate your sleep quality overall?				

- Component 1 #9 Score .....
- C1 \_\_\_\_\_ Component 2 #2 Score ( $\leq 15$ min=0; 16-30 min=1; 31-60 min=2, >60 min=3) + #5a Score (if sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3).....
- C2 \_\_\_\_\_ Component 3 #4 Score ( $>7=0$ ; 6-7=1; 5-6=2;  $<5=3$ ).....
- C3 \_\_\_\_\_ Component 4 (total # of hours asleep)/(total # of hours in bed) x 100  
 $>85\%=0$ ,  $75\%-84\%=1$ ,  $65\%-74\%=2$ ,  $<65\%=3$ .....
- C4 \_\_\_\_\_ Component 5 Sum of Scores #5b to #5j (0=0; 1-9=1; 10-18=2; 19-27=3).....
- C5 \_\_\_\_\_ Component 6 #6 Score .....
- C6 \_\_\_\_\_ Component 7 #7 Score + #8 Score (0=0; 1-2=1; 3-4=2; 5-6=3) .....
- C7 \_\_\_\_\_

Add the seven component scores together \_\_\_\_\_ **Global PSQI Score**

**A global sum of "5" or greater indicates a "poor" sleeper.**

## APPENDIX – IV

### **BERLIN QUESTIONNAIRE**

Height (m)\_\_\_\_\_ Weight (kg)\_\_\_\_\_

Age \_\_\_\_\_ Male/Female

Please choose the correct response to each question.

#### **CATEGORY 1**

1. **Do you snore?**

- a. Yes
- b. No
- c. Don't know

*If you snore:*

2. **Your snoring is:**

- a. Slightly louder than breathing
- b. As loud as talking
- c. Louder than talking
- d. Very loud – can be heard in adjacent rooms

3. **How often do you snore**

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

4. **Has your snoring ever bothered other people?**

- a. Yes
- b. No
- c. Don't Know

5. **Has anyone noticed that you quit breathing during your sleep?**

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

#### **CATEGORY 2**

6. **How often do you feel tired or fatigued after your sleep?**

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

7. **During your waking time, do you feel tired, fatigued or not up to par?**

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

8. **Have you ever nodded off or fallen asleep while driving a vehicle?**

- a. Yes
- b. No

*If yes:*

9. **How often does this occur?**

- a. Nearly every day
- b. 3-4 times a week
- c. 1-2 times a week
- d. 1-2 times a month
- e. Never or nearly never

#### **CATEGORY 3**

10. **Do you have high blood pressure?**

- Yes
- No
- Don't know

## Scoring Berlin questionnaire

The questionnaire consists of 3 categories related to the risk of having sleep apnea. Patients can be classified into High Risk or Low Risk based on their responses to the individual items and their overall scores in the symptom categories.

### **Categories and scoring:**

Category 1: items 1, 2, 3, 4, 5.

Item 1: if 'Yes', assign **1 point**

Item 2: if 'c' or 'd' is the response, assign **1 point**

Item 3: if 'a' or 'b' is the response, assign **1 point**

Item 4: if 'a' is the response, assign **1 point**

Item 5: if 'a' or 'b' is the response, assign **2 points**

**Add points. Category 1 is positive if the total score is 2 or more points**

Category 2: items 6, 7, 8 (item 9 should be noted separately).

Item 6: if 'a' or 'b' is the response, assign **1 point**

Item 7: if 'a' or 'b' is the response, assign **1 point**

Item 8: if 'a' is the response, assign **1 point**

**Add points. Category 2 is positive if the total score is 2 or more points**

**Category 3 is positive if the answer to item 10 is 'Yes' OR if the BMI of the patient is greater than 30kg/m<sup>2</sup>.**

(BMI must be calculated. BMI is defined as weight (kg) divided by height (m) squared, i.e., kg/m<sup>2</sup>).

**High Risk:** if there are 2 or more Categories where the score is positive

**Low Risk:** if there is only 1 or no Categories where the score is positive

## APPENDIX V

### ASSESSMENT FORM

NAME

AGE

SEX

ADDRESS

PHONE NO

	DAY TIME SLEEPINESS	SLEEP QUALITY	SNORING FREQUENCY	SNORING INTENSITY	NECK CIRCUMFERENCE in cm
PRE TEST					
POST TEST					

## APPENDIX VI

### TONGUE EXERCISES

- Stand in front of the mirror; brush the upper and either sides of the tongue gently. All the while tongue should be positioned in the floor of the mouth.  
Continue this procedure for 3 minutes  
Take 1 minute rest
- Place the tip of the tongue against the front part of the roof of your mouth; gently slide the tongue backwards and forwards.  
Continue this procedure for 3 minutes  
Take 1 minute rest
- Suck your tongue upward forcefully against the front part of the roof of the mouth, pressing the entire tongue against the same part  
Continue this procedure for 3 minutes  
Take 1 minute rest

### FACIAL EXERCISES

- Close your mouth tightly with the lips for 30 seconds and relax.  
Continue this procedure for 3 minutes  
Take 1 minute rest
- Suck the air inside your mouth using cheek muscles  
Continue this procedure for 3 minutes  
Take 1 minute rest
- Raise your cheek alternatively on either side intermittently with the lips  
Continue this procedure for 3 minutes.  
Take 1 minute rest

### FUNCTIONAL EXERCISES

- Sit straight in a chair, breath in forcefully through the nose, breath out through the mouth by producing sounds like Aaa, Ooo, Eee etc.  
Continue this procedure for 3 minutes  
Take 1 minute rest
- Breath in through the nose, while breath out forcefully blow the balloon.  
Continue this procedure for 3 minutes  
Take 1 minute rest
- Alternately chew and swallow using the tongue in the roof of the mouth, whenever feeding.  
Continue this procedure for atleast 7 minutes  
Take 1 minute rest after 3 minutes

## APPENDIX VII

### 1. முகத் தசைகளுக்கான பயிற்சிகள்

- ❖ உதடுகளால் வாயை இறுக்கமாக மூடி 30 நொடிகள் வைத்திருந்து பின்பு விடவும்.  
பயிற்சியினை மூன்று நிமிடங்கள் தொடர வேண்டும். ஒரு நிமிட ஓய்வு எடுத்துக் கொள்ளலாம்.
- ❖ கன்னத்திலுள்ள தசைகளைப் பயன்படுத்தி வாயினுள் காற்றை உறிஞ்ச வேண்டும்.  
பயிற்சிகளை மூன்று நிமிடங்களைத் தொடர வேண்டும். ஒரு நிமிடம் ஓய்வெடுத்துக் கொள்ளலாம்.
- ❖ சீரான இடைவெளி விட்டு கன்னத் தசைகளை உதடுகளின் மூலம் இருபுறமும் மாற்றி மாற்றி உயர்த்த வேண்டும்.  
பயிற்சிகளை மூன்று நிமிடங்களைத் தொடர வேண்டும். ஒரு நிமிடம் ஓய்வெடுத்துக் கொள்ளலாம்.

### 2. செயல்முறைப் பயிற்சிகள்

- ❖ நேராக இருக்கையில் அமர்ந்து மூக்கின் மூலம் முச்சைப் உள்ளிழுத்து, வாயின் வழியாக ஆ...ஊ...ஈ... போன்ற சத்தங்களுடன் வெளிவிடவும்.  
பயிற்சியினை இரண்டு நிமிடங்கள் தொடர்ந்து ஒரு நிமிடம் ஓய்வு எடுத்துக் கொள்ளலாம்.
- ❖ மூக்கின் வழியாக முச்சை உள்ளிழுத்து வாயின் வழியாக பலூனில் ஊத வேண்டும்.  
பயிற்சியினை மூன்று நிமிடங்கள் தொடரவும். ஒரு நிமிடம் ஓய்வெடுத்துக் கொள்ளலாம்.

- ❖ உணவருந்தும் போதெல்லாம் உணவை வாயின் இருபுறங்களிலும் மாற்றி மாற்றி மெல்ல வேண்டும். மேலும் நாலைப் பயன்படுத்தி உணவை விழுங்க வேண்டும்.

குறைந்தபட்சம் 7 நிமிடங்கள் இந்தப் பயிற்சியைத் தொடர வேண்டும். மூன்று நிமிடங்களுக்குப் பின் ஓய்வெடுத்துக் கொள்ளலாம்.

### 3. நாக்கிற்கான பயிற்சிகள்

- ❖ கண்ணாடியின் முன்பாக நின்று கொண்டு நாவின் மேல்புறமும், பக்கங்களிலும் மெதுவாக பிரஷ் செய்யவும். பயிற்சியின் போது நாக்கு வாயின் அடிப்பாகத்திலே இருக்க வேண்டும்.

பயிற்சியினை மூன்று நிமிடங்கள் தொடர வேண்டும். ஒரு நிமிடம் ஓய்வெடுத்துக் கொள்ளலாம்.

- ❖ நாவின் நுனியை வாயின் முன் பகுதியில் மேற்புறம் ஒட்டியவாறு வைத்தக் கொள்ள வேண்டும். மெதுவாக மேல்புறத்தை உரசியவாறு நாலை முன்னும், பின்னும் நகர்த்த வேண்டும்.

பயிற்சியினை மூன்று நிமிடங்கள் தொடர வேண்டும். ஒரு நிமிடம் ஓய்வெடுத்துக் கொள்ளலாம்.

- ❖ வாயின் முன் பகுதியிலிருந்து மேற்புறத்தை ஒட்டி நாலை வலுவுடன் உறிஞ்ச வேண்டும், வாயின் மேற்புறத்தில் முழு நாவையும் வைத்து அழுத்த வேண்டும்.

பயிற்சியினை மூன்று நிமிடங்கள் தொடர்ந்து ,ஒரு நிமிடம் ஓய்வு எடுத்துக் கொள்ளலாம்.

## APPENDIX VIII

### **\M;N\PA HYMBMAŠÄ (I®MSNBPSS AP¼NÂ \N¶V SNT¿-XV)**

- HMB XPD¶P ]NSN;PI, \M;V APIFNTE;V T]MMSX KQEN;WŴ, {\_JV SIM-V \M;NSÂ APIÄHIHPŴ CCPHIŠFPŴ AIT¶;V {\_JV SN¿WŴ.

(3 AN\NÄV SN¿PI)

(1 AN\NÄV HN{IAN;PI)

- \M;NSÂ AÄW APIFNES¶ ]ÄNSÂ ]PDINÂ SH¨ PSIM-V ]PDTIM\*PW APT¶M\*PW\O;PI.

(3 AN\NÄV SN¿PI)

(1 AN\NÄV HN{IAN;PI)

- \M;V A®M;NTE;V H\*NBNCN;P¶XV T]MSE IÄNBMBN APIFNTE;V AÄÄ¶PI.

(3 AN\NÄV SN¿PI)

(1 AN\NÄV HN{IAN;PI)

### **APJIN\PA HYMBMAŠÄ**

- NP-PIÄ AÄÄ¶NAQSPI, AP\_XV SK;ÄV ]NSN¨ P HBV;PI, AXN\PTIJW HNSPI.

(3 AN\NÄV SN¿PI)

(1 AN\NÄV HN{IAN;PI)

- KVT{SM H¨V DÄNTE;V HEN;P¶XV T]MSE IHNFPÄ HEN¨V ]NSN;PI.

(3 AN\NÄV SN¿PI)

(1 AN\NÄV HN{IAN;PI)

- NP-NSÂ CCPHIŠFPŴ D]TBMKN¨V IHNFPÄ APIFNTE;V DBÄ¶PI.

(3 AN\NÄV SN¿PI)

(1 AN\NÄV HN{IAN;PI)



## {]HÄ\]CMB HYMBMAŠÄ

- ITKCBNÄ T\SC CCN;PI, AQ;V SIM-V IÄNBMBV HMBP DÄNTE;V FSPIV B, HM, CU FTO  
AŁCŠÄ JD<sup>a</sup>V SIM-V HMBNEQSS JPDT;V HNSPI.

( 3 AN\NÄV SN;PI)

( 1 AN\NÄV HN{LAN;PI)

- IÄNBMBV AQ;NEQSS IZKN" PSIM-V \_EQ- DUXN HOÄ, N;PI.

( 3 AN\NÄV SN;PI)

( 1 AN\NÄV HN{LAN;PI)

- `ŁWŴ IGN;PT¼MÄ \M;PSIM-V `ŁW]ZMÄ°ŠÄ APIFNTE;V H"PSIM-V NHBV;PIBPW  
CD;PIBPW SN;PI.

( IPD<sup>a</sup>XV 7 AN\NÄV SN;PI)

( 1 AN\NÄV HN{LAN;PI)