Original Research Article

Effect of CPAP, CPAP with Lifestyle changes and CPAP with Pranayama on Anthropometric evaluation in obese Diabetic subjects with Obstructive Sleep Apnea

[1]Shah VK, [2]Badade ZG, [3]Banerjee A, [4]Rai S, [5]More K

[1,2,5]Department of Biochemistry, MGM Medical College, Navi Mumbai, Maharashtra, India
[3]Department of Neurology and Director of MGMIHS Sleep Medicine and research Centre, MGM Medical College, Navi Mumbai, Maharashtra, India
[4]Department of Medicine, MGM Medical College, Navi Mumbai, Navi Mumbai, Maharashtra, India

Corresponding Author:
Vijay Kumar Shah (vijay_shah88@live.com)

Abstract

Background: The incidence of OSA among persons who have type 2 diabetes may vary anywhere from 8.5% to 86%. Obstructive sleep apnea is more common in people of South Asian heritage who have type 2 diabetes (OSA). People of South Asian descent who have been diagnosed with type 2 diabetes tend to be overweight, and this obesity has been associated to obstructive sleep apnea.
Method: In present study 246 subjects received Polysomnography (PSG) and among them 192 assessed for CPAP titration. 78 participants were removed due to inclusion criteria, CPAP intolerance, refusal to participate, those who can't afford treatment, etc. The remaining 114 subjects were obese non-diabetics (61) and obese type 2 diabetics (53). These 53 obese diabetic subjects were divided into 3 groups: CPAP group, CPAP with Lifestyle changes and CPAP with Pranayama group. Follow-up was done after six-month.
Result: We found BMI, Waist Circumference, Hip Circumference and Neck Circumference were decreased in all three-study groups after six months of interventions. It was very highly Significant ($p<0.001$) in all groups. We have also found a positive correlation with AHI and Anthropometric evaluation.
Conclusion: The pattern of sleep improved across the all-different stages of sleep. Using CPAP in conjunction with these two interventions not only improves the success rate of treating OSA, but also shortens the overall time necessary for therapy.

Keywords: CPAP, BMI, waist circumference, hip circumference, neck circumference OSA, lifestyle changes, pranayama, diabetic

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Introduction

Obstructive sleep apnea, often known as OSA [1], is very prevalent among both those who have and do not have type 2 diabetes mellitus (T2DM). It should not come as a surprise that obstructive sleep apnea and type 2 diabetes mellitus (T2DM) are often found together because the two conditions share risk factors, such as obesity and age, and because obstructive sleep apnea has been identified as an independent risk factor for the development of incident diabetes. Numerous studies have indicated that the incidence of OSA among persons who have type 2 diabetes may vary anywhere from 8.5% to 86% [2, 3]. Obstructive sleep apnea is more common in people of South Asian heritage who have type 2 diabetes (OSA). People of South Asian descent who have been diagnosed with type 2 diabetes tend to be overweight, and this obesity has been associated to obstructive sleep apnea [2].

Obesity, and particularly obesity in the upper body, is regarded as one of the most important risk factors for obstructive sleep apnea (OSA). The prevalence of obstructive sleep apnea (OSA) has been estimated to range from 42–48% in males and 8–38% in women in very obese people. This is a 10-fold increase in risk in comparison to what is typically seen in adults [4]. The incidence of obstructive sleep apnea (OSA) rises as a result of obesity due to the constriction of the pharynx Extra fat in the tongue, soft palate, and uvula may potentially contribute to OSA [5].

However, type 2 diabetes mellitus (DM) is now understood to be a progressive chronic condition that has a heavy monetary, health, and life-threatening toll [6]. The link between OSA and DM has been extensively researched because to the same risk factors between the two conditions. Diabetes has been identified in 20-30% of people with OSA in cross-sectional investigations. Also, regardless of BMI, 23% of diabetic individuals were found to have OSA (BMI) [7, 8].

When it comes to the management of obstructive sleep apnea, it is probable that one of the most beneficial treatment options would be to attain and maintain a substantial decrease in body weight. This objective might be accomplished via the use of behavioural, pharmacological, or surgical methods [3].

Weight reduction has been shown to be associated with improvements in a number of parameters related to obesity and OSA. These findings lend credence to the hypothesis that weight loss might be an essential component in the treatment of both disorders. Continuous Positive Airway Pressure (CPAP) is the therapy that is now regarded as the gold standard for Obstructive Sleep Apnea (OSA) [9].

However, since obstructive sleep apnea is a complicated disorder, the therapy cannot be confined to addressing a single component of the illness or symptom. It would be more accurate to say that in order to achieve therapeutic success that is both effective and long-lasting, it is necessary to implement a plan that is integrated and involves several disciplines. This indicates that more treatments are required. In light of this, the purpose of this research was to investigate the influence of pranayama, modifications in lifestyle, and continuous positive airway pressure (CPAP) on anthropometric measurements in diabetic obese individuals who suffered from obstructive sleep apnea.

Material and Methods

The present study is prospective study carried out in the Department of Biochemistry and MGMIHS Sleep Medicine and Research Centre, MGM Medical College & Hospital, Navi Mumbai, in association with the Division of Sleep Medicine, University of Pennsylvania, USA. Study period from February 2016 to February 2019. The present study comprises obese diabetic with obstructive sleep apnea (OSA) subjects enrolled based on the Sleep Disorder Screening Questionnaire. The Institutional Ethics Committee approval (MGMIHS.RE.02:2015:23) was obtained before initiating the study.

Inclusion criteria

Obese diabetic with OSA

Exclusion criteria

The following subjects were not included in the study: those under 20 and over 60, those with neurological or cardiovascular conditions, People in psychiatric facilities, pregnant women, hypothyroid patients, etc.

Study Procedure

246 subjects received polysomnography (PSG) and among them 192 assessed CPAP titration. 78 participants were removed due to inclusion criteria, CPAP intolerance, refusal to participate, those who can't afford treatment, etc. The remaining 114 subjects were 61 obese non-diabetics and 53 obese type 2 diabetics. Then subjects were further divided into 3 groups: CPAP only group, CPAP with Lifestyle changes and CPAP with Pranayama group. Patients were instructed to follow the intervention very strictly. Use of CPAP is recommended for 6-8 hours each night. After the intervention of six months, a follow-up study was done. Written consent was obtained from each participant.

Intervention

Group 1 (CPAP only group)

Group 2 (CPAP with Lifestyle changes)

Subjects were given the goal of losing 10% or more of initial weight so that the study group would attain a mean loss ≥ 7% within Six months. They were motivated to do aerobic activity, exercise or brisk walking by increasing their daily steps by 250 a week until they reach a goal ≥ of 10,000 steps/day. They were encouraged to replace two meals (typically breakfast and lunch) with a liquid shake (meal) and one snack. They were allowed to consume an evening meal of conventional food and emphasized eating more fruits & vegetables & other foods consistent with a low-energy-density diet [10].

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Group 3 (CPAP with Pranayama group)

Subjects were instructed to practice Pranayama >200 min/week and completely smoking cessation.

Statistical analysis

SPSS Ver. 21 was used. Welch's t-test (Unequal sample size) was used to compare the Mean between the different groups. Descriptive were expressed as (mean ± SD).

Results

In this study, we found BMI, Waist Circumference, Hip Circumference and Neck Circumference were decreased in all three-study groups after six months of interventions. It was very highly Significant ($p<0.001$) in all groups.

We have found a positive correlation, BMI with AHI in all groups and were statistically significant ($p<0.05$). (r = 0.66, 0.73 and 0.69, respectively)

We have found a positive correlation, Waist Circumference with AHI in all groups and were statistically significant ($p<0.05$). (r = 0.67, 0.62 and 0.58, respectively)

We have found a positive correlation, Hip Circumference with AHI in all groups and were statistically significant ($p<0.05$). (r = 0.71, 0.72 and 0.54, respectively)

We have found a positive correlation, Neck Circumference with AHI in all groups and were statistically significant ($p<0.05$). (r = 0.60, 0.64 and 0.74, respectively)

Table 1: Comparison of Anthropometric evaluation on obese Diabetic Subjects.

Groups/Variance	**Only CPAP**		**CPAP with life style change / exercise**		**CPAP with pranayam**	
Mean± SD	**Baseline**	**After 6 Months**	**Baseline**	**After 6 Months**	**Baseline**	**After 6 Months**
BMI	30.76 ±4.19	28.19 ±3.80 ***	30.40 ±3.65	27.64 ± 2.62***	30.12 ±5.02	26.99 ±3.34***
Waist Circumference (cm)	107.86 ±16.51	102.43 ±15.34***	106.10 ±5.69	99.20 ± 5.61***	108.20 ±7.97	100.70 ±6.11***
Hip Circumference (Cm)	110.00 ±14.09	106.71 ±13.14***	110.80 ±5.12	105.70 ± 4.92***	111.90 ±6.05	105.90 ±5.59***
W/h Ratio	0.98 ±0.03	0.96 ±0.03***	0.96 ±0.02	0.94 ± 0.04*	0.97 ±0.02	0.95 ±0.01**
Neck Circumference (cm)	39.71 ±1.35	38.43 ±0.73***	40.90 ±1.15	38.60 ±0.94***	40.55 ±1.50	37.95 ±1.23***

Values are expressed as mean ± SD. ***$p<0.001$(Very highly significant), **$p<0.01$ (Highly Significant), *$p<0.05$ (Significant)

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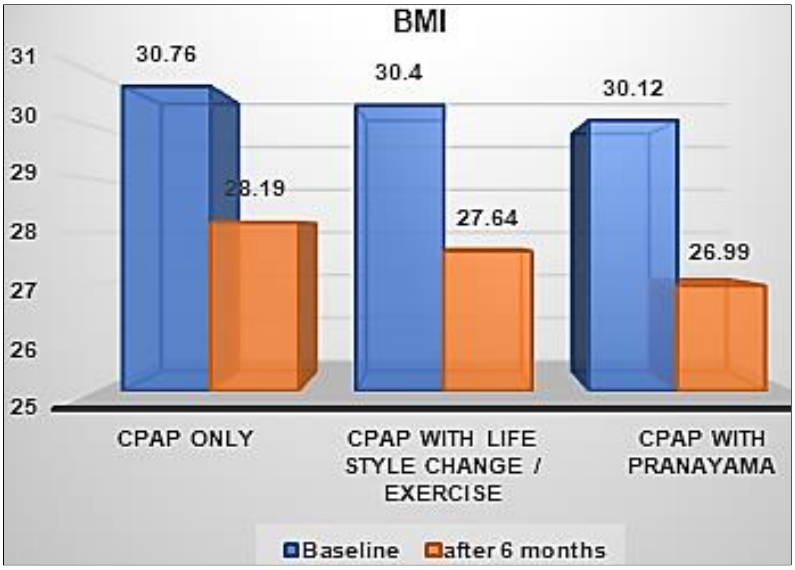
Table 2: Correlation between AHI with Anthropometric evaluation

AHI	Anthropometric evaluation	r value
Only CPAP Group	BMI	0.66*
	Waist Circumference	0.67*
	Hip Circumference	0.71*
	W/h Ratio	0.53*
	Neck Circumference	0.60*
CPAP with life style change / exercise	BMI	0.73*
	Waist Circumference	0.62*
	Hip Circumference	0.72*
	W/h Ratio	0.60*
	Neck Circumference	0.64*
CPAP with PRANAYAM	BMI	0.69*
	Waist Circumference	0.58*
	Hip Circumference	0.54*
	W/h Ratio	0.64*
	Neck Circumference	0.74*

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).



Graph 1: Shows Comparison of BMI in Diabetic groups

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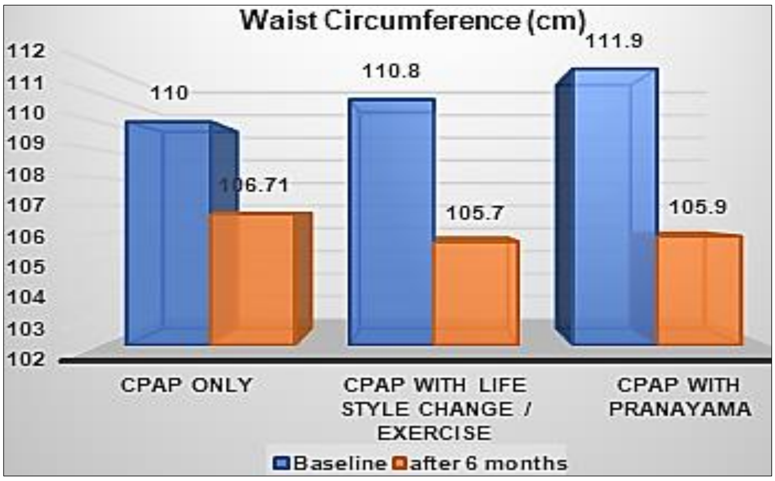
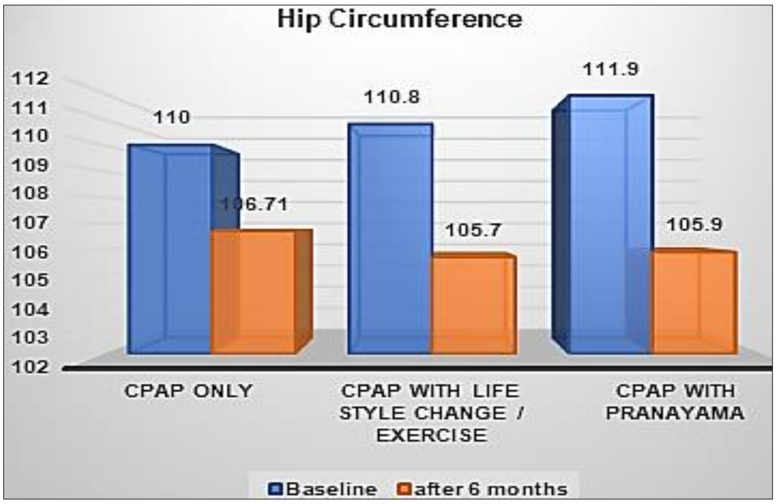
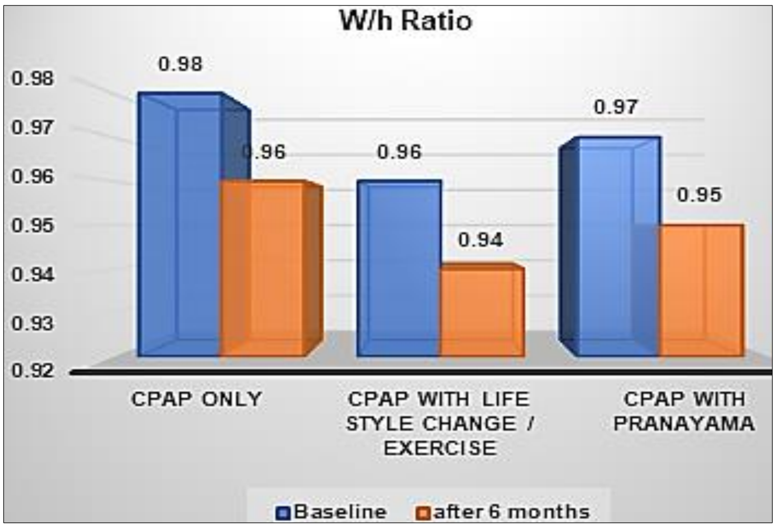


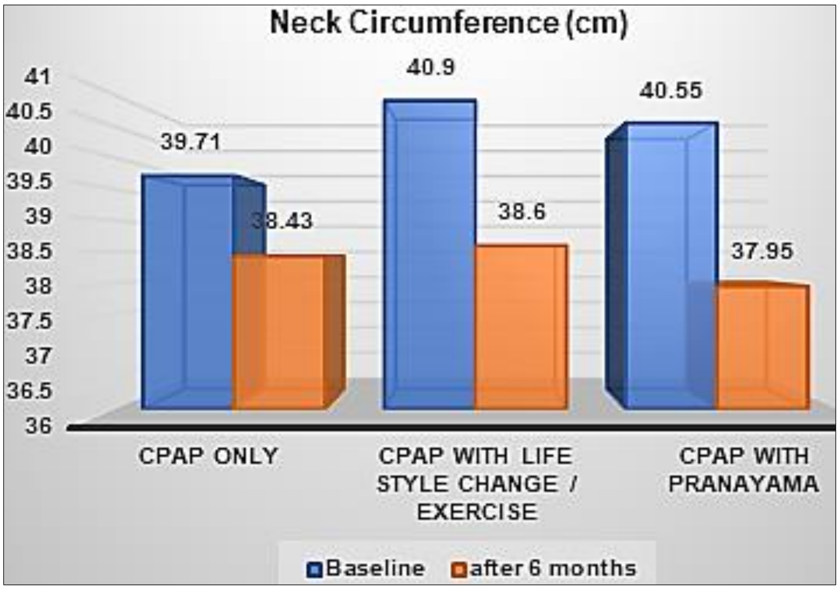
Graph 2: Shows Comparison of Waist Circumference in Diabetic groups



Graph 3: Shows comparison of hip circumference in diabetic groups



Graph 4: Shows Comparison of W/H Ratio in Diabetic groups



Graph 5: Shows Comparison of Neck Circumference in Diabetic groups

Discussion

People with OSA have been the participants of many CPAP experiments. While CPAP has been shown to be effective in treating OSA, only a few of studies have examined its use in combination with other therapies. Although combination therapy has the potential to reduce treatment time without losing efficacy, there is a dearth of research on the topic. We set out to conduct this research to provide answers to these queries. The benefits of CPAP, CPAP with lifestyle modification and CPAP with pranayama on anthropometric assessment in people with obese type 2 diabetes and OSA have not yet been studied. Only a couple of another research are slightly comparable to ours. For this reason, the present results disclose for the first time.

Obesity markers such as body mass index and waist-to-hip ratio are strong indicators of future diabetes development. The greater accumulation of fat in the upper part of the body might explain many of the obesity-related problems, including OSA, found in adult males [11].

Our study demonstrated BMI, Waist Circumference, Hip Circumference and Neck Circumference were decreased in all three-study groups after six months of interventions. It was very highly Significant ($p<0.001$) in all groups. We have found a positive correlation of BMI, Waist Circumference, Hip Circumference and Neck Circumference with AHI in all groups and were statistically significant. In a study by Chan *et al*. [11] shown that diabetes risk is positively and significantly correlated with general obesity as determined by body mass index (BMI). It was shown that both body mass index (BMI) at age 21 and absolute weight increase in adulthood were substantial independent risk factors for diabetes. Waist-to-hip ratio (WHR) was only a decent predictor of diabetes in the top 5%, whereas waist circumference was positively related with the risk of diabetes in the top 20%.

Ari Shechter *et al*. in 2017 found that differences in HbA1c were linked to weight. The results suggest that in T2D patients with OSA, weight loss resulting from a lifestyle intervention is more essential than decreases in AHI for improving glycaemic control [12].

A randomised controlled trial by Kuna Samuel T *et al*. in 2013 studied that over 4 years, comprehensive lifestyle intervention resulted in higher reductions in weight and apnea-hypopnea index among obese people with type 2 diabetes and OSA than with diabetes support and education alone. Significant weight reduction accounted for most of the improvement in the apnea-hypopnea index after strict lifestyle modification [13].

Foster Gary *et al*. in 2009 reported in their study on the effect of weight loss on obstructive sleep apnea among obese patients with type 2 diabetes. It was shown that initial AHI and weight reduction were the best predictors of changes in AHI at 1 year. Losses in AHI were highest among those who lost 10 kg or more [14]. This result supports our result strongly.

It shouldn't come as a surprise that individuals who battle with their weight often seem to have trouble sleeping. There is a correlation between losing weight and both a considerable improvement in sleep complaints and also reduction in symptoms of exhaustion throughout the daytime. People who are obese, have obstructive sleep apnea (OSA), and lose a considerable amount of weight by purposeful weight reduction often see significant improvements in their quality of sleep.

Increased sympathetic activity during sleep is connected to intermittent hypoxia, the primary cause of the metabolic shift seen in OSA. A rise in free fatty acid in the blood, brought on by an increase in lipolysis after sympathetic nervous system activation, leads to insulin resistance [15]. Although insulin resistance seems to play a key role. Incorporating interventions into CPAP therapy has been shown in our study to decrease AHI significantly, which in turn raises oxygen saturation and decreases the release of free fatty acids into the bloodstream. It's possible that by restoring normal insulin levels and stimulating the metabolism, people have lost weight, hip circumferences, waist circumferences and neck circumferences.

Conclusion

The findings of this study highlight the significant health benefits that occur from weight loss for very obese diabetic individuals who suffer from OSA. It has been shown that decreasing weight improves sleep breathing episodes, sleep quality, subjective tiredness, bio-chemical indicators of metabolic syndrome, depressive symptoms and body image. The dramatic improvement in people's standard of living may be directly attributed to these adjustments. One may argue that the benefits of treating illnesses and ailments that are so closely linked with obesity would only be realised with a substantial amount of weight reduction. The anthropometric evaluation revealed that individuals using CPAP for the treatment of sleep apnea exhibited the greatest improvement in those practising Pranayama and lifestyle changes as compared to CPAP alone. Using CPAP in conjunction with any of these methods not only improves anthropometric measurements that are helpful in treating OSA, but also diminishes the total time spent on treatment.

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Limitations of this study

Our research has of a small sample size, so to further investigate the relationship between CPAP therapy and improved sleep quality, larger trials that are prospectively controlled are required.

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