Original Research Article

Comparison of pre and post meal sleepiness in obese individuals using Multiple sleep latency test

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Abstract

Introduction: Obesity has become a major health issue in India. It is a condition with excessive fat accumulation in the body to the extent that the health and wellbeing are adversely affected. The healthy BMI range varies with age and sex of the individual. Obesity in children and adolescents is defined as a BMI greater than the 95thpercentile. It can also be defined as a body weight at least 20% higher than a healthy weight for a child of that height or a body fat percentage above 25% in boys or above 32% in girls. There are limited studies related to the pre and post meal sleepiness in obese individuals. **Materials and methods**: This study was conducted on thirty subjects out of which fifteen were obese and rest were nonobese to measure the sleep latency before and after the influence of standard meal using polysomnography and also to explore the relationship between obesity and subjective measure of sleepiness using Epworth Sleepiness Scale. **Results and discussion:** Statistical analysis was done using student's 't'test. In this study we observed that with increase in BMI there was an increase in both objective and subjective measure of sleepiness. There was no statistical significance in mid sleep latency test after meals between the control group and study group. However, the effects of meal size, various types of food on sleep were not explored in this study. **Conclusion:** The conclusion of this study is treatment should always be focused on the underlying cause promoting appropriate sleep quantity and quality by establishing good sleep hygiene.

Key words: daytime sleepiness, latency tests, obesity, sleep

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Introduction

Obesity has become a major health issue in India. It is a condition with excessive fat accumulation in the body to the extent that the health and wellbeing are adversely affected. The healthy BMI range varies with age and sex of the individual. Obesity in children and adolescents is defined as a BMI greater than the 95thpercentile. It has now become an important health problem in developing countries particularly in India.[1]

Excessive Daytime sleepiness (EDS)

Daytime sleepiness and fatigue are frequent complaint of obese people even among those who does not demonstrate sleep apnea or any degree of sleep disordered breathing.[2]

EDS is the primary concern for many patients presenting with sleep disorder and a significant public health problem. The International Classification of Sleep Disorders (ICSD-2) includes EDS as an essential feature for three diagnostic categories; narcolepsy, hypersomnia and behaviorally induced insufficient sleep syndrome. EDS is associated with poor performance in the workplace[3] and reduced quality of life with serious economic consequences.

Obesity is accompanied by considerable sleep disturbance and is the greater risk factor for obstructive sleep apnea (OSA) in adults[4]. Excessive daytime sleepiness is also very common in obese subjects and is not necessarily restricted to those with obstructive sleep apnea (OSA).

Multiple sleep latency test is a validated objective measure of sleepiness[5]. The multiple sleep latency test, which may be considered a standard for measuring excessive daytime sleepiness, is associated with sudden sleep attacks or irresistible sleepiness.

In the present study a balanced meal was provided to both the non-obese and the obese subject on the day of which the study was conducted. A balanced meal requirement for moderately exercising individuals 60% carbohydrate, 20% protein and 20% fat content. The meal consisted of 2 chapatti, 1 cup greens with dal, 1 cup rice, 1 cup curd, 1 cup mixed vegetable side dish, 1 banana. The meal was designed such that it was a balanced diet of moderate meal size with a moderate glycemic index.

Aim & Objective

The aim of our study was to assess in sleep laboratory whether obese patients without sleep apnea have sleepiness during the day compared with healthy controls with normal weight, and their response to food before meal (pre-meal) and after meal (Post-meal) consumption.

The present study was designed to explore the relationship between obesity and subjective measure of sleepiness using Epworth Sleepiness Scale and objective measures of sleepiness using Multiple sleep Latency Test and the effect of food on sleep.

Obesity

The World Health Organization (WHO) has declared over weight as one of the top ten health risks in the world and one of the top five in developed nations (WHO, 2002). Obesity is defined as a state of excess adipose tissue mass[6]. The WHO defines ‘over weight’ as a BMI equal to or more than 25, and ‘obesity’ as a BMI equal to or more than 30. These cut off points provide bench mark for individual assessment, but there is evidence that risk of chronic disease in populations increases progressively from a BMI of 21 onwards (WHO fact sheet 2006).

While weight gains were largely beneficial to the health and longevity of our ancestors, an alarming number of people have now crossed the line beyond which further gains are dangerous. Severely obese people die 8-10 years sooner than those of normal-weight, similar to smokers, with every 15 extra kilograms increasing risk of early death by approximately 30%. Obesity is estimated to be responsible for 1% to 3% of total health expenditure in most countries. Women are more often obese than men, but male obesity rates have been growing faster than female rates in most countries.

The Body Mass Index is a measure of the body weight relative to height which can be used to determine if the individual is underweight, at a normal weight, overweight or obese.

(*In India, Normal BMI is less than 23, Overweight is above 23 and Obese is above 25 as per revised values by The Health Ministry in 2008)The score is valid for both men and women but it does have some limits.

The limits are:

It may overestimate body fat in athletes and others who have a muscular build.

It may underestimate body fat in older persons and others who have lost muscle mass.

For many Asian populations, additional trigger points for public health action were identified as 23 Kg/m^2 or higher, representing increased risk, and 27.5 Kg/m^2 or higher as representing very high risk.

Multiple Sleep Latency Test (MSLT) and Epworth Sleepiness Scale (ESS)

The ESS is the most widely used subjective measure of sleepiness. This takes the form of a questionnaire where patients rate their perceived likelihood of falling asleep in eight everyday situations, to give a score from 0-24 points.[7]Although the test is quick and easy to administer; it is dependent on the subject's interpretation of the rating system. It may be less reliable in very sleepy patients and can be affected by social, cultural and psychological factors such as anxiety or depression and gender.[8]

The best available objective measure of sleepiness is mean sleep latency, as measured by the MSLT, where patients take successive naps at 2-hour interval land the time to sleep onset is measured using polysomnographic criteria. Generally, a mean sleep latency of less than 15 minutes is considered being mildly sleepy, less than 10 minutes is moderately and less than 5 minutes qualifies as severely sleepy.[8]. However, both objective and subjective measures of sleepiness may be confounded by factors such as the patient's motivation to stay awake (Bonnet MH et al., 2005) sleep hygiene or the previous night's sleep quality and quantity.

Effect of Meals on MSLT

The influence of meal over daytime sleepiness cannot be overlooked. Several studies[9] has demonstrated that there is a difference in the feeling of sleepiness after a fat rich and a carbohydrate rich meal. In a study by Anita S. Wells et al., 1996 showed that subjects reported a tendency of increased sleepiness, with an increase in time, after ingestion of high-fat low-CHO diet than a low-fat-high-CHO diet.

In a study by Stahl M.L. et al in 1983 showed that there was no significant difference in the sleep latency of the subjects post meal consumption when compared with the fasting subjects. However, no pre-meal test was done and the subject may have attained peak sleepiness 1-1.5 Hrs after food, which was not measured. In another study Clarskadon M.A. et al., 1987, showed that irrespective of a small (1,516KJ) or a large meal (5,061KJ) the sleep latency was reduced after meals which is due to the daytime peak in sleepiness in the early afternoon due to the circadian rhythm or whether it was due to the combination of the time of the day and food ingested.

The influence of meals on sleep mainly depends on the type of food consumed.

Materials and Methods

Study design was a Prospective cross-sectional case control study. The present study was carried out among 30 subjects with 16 adult females and 14 adult males of age between 20-35 years. The

Medical history was collected using standard questionnaire. Anthropometric assessment, physical examination and assessment of pre-meal and post-meal latency were performed on all the study subjects as per the methodology.

A balanced meal was provided to both the non-obese and the obese subjects on the day of which the study was conducted. A balanced meal requirement for moderately exercising individual, with a moderate glycemic index. The study was approved by the institutional ethical committee and written consent from the subjects was obtained for carrying out the study after explaining to them the protocol of the study and the benefits of the study.

Survey Instruments:

Questionnaire used for obtaining medical history was designed and validated. Examination proforma used for recording the clinical examination findings was designed and validated. Multiple sleep latency was performed using the polysomnography equipment Medicaid PS-21.

Epworth sleepiness scale was used to measure the general level of daytime sleepiness.

Exclusion Criteria

- Subjects below and above the age range of 20-35 years, Subjects with neurological disorders like epilepsy, stroke, sleep related disorders such as narcolepsy, excessive day time sleepiness (ESS score of 9 and above, Subjects with disturbed nocturnal sleep and Periodic limb movement disorder, shift workers were excluded.

Conventional Montage

According to international guidelines (Carskadon MA et al., 1986) MSLT was carried out during daytime. MSLT was comprised of four 20-min nap trials at intervals of 2h. The recording montages were similar to that of the Polysomnogram (PSG), except that chest and abdominal strain gauges were not included. The nap trial was terminated at 20 min if the subject did not achieve sleep, but was continued for 15 min after the onset of sleep if sleep had occurred within 20 min.

Sleep latency was defined as the duration in minutes from lights-out to the first phase of sleep in nap trial. Normally, the onset of sleep is within 10-20 minutes. Sleep latency less than 5 minutes is considered to be of pathological significance. Mean sleep latency was calculated using MSLT data from two trials pre-meal and two trials post-meal.

Epworth sleepiness scale

ESS is a self-administered questionnaire designed to measure the general level of daytime sleepiness. Patients rate on a scale of 0-3 their likelihood of falling asleep in eight different situations commonly encountered in daily life. Total ESS score ranges from 0 to 24; higher scores indicate more subjective sleepiness. All questionnaires were completed on the morning of the MSLT recording.

ESS Score Interpretation

Score 1-6: getting enough sleep

Score 7-8: Average sleep

Score 9 and above: very sleepy, should seek medical advice

Statistical Analysis:

The data collected were entered in MS Excel Spread Sheet. Descriptive table was generated and appropriate statistical analysis was done using SPSS 20.0 software. Student t-test was applied to compare sleep latency of non-obese and obese individuals and to analyze the difference in sleep latency before and after meal consumption in both the groups. A significance level of p value <0.05

was considered for the student t-test. The data were expressed as mean ± standard deviation.

Results and discussion

Our study was conducted on 30 subjects (15 obese and 15 non-obese; 8 female and 7 males in each group) to measure the sleep latency of obese and non-obese adults before and after the influence of a standard meal. Statistical analysis was done using student's 't'test and the following results were obtained.

Table-1 Pre-Meal and Post – Meal Sleep Latency Comparison in non-obese individuals

Group N=15	Mean±SD	Independent t value	P value
Pre-Meal Min	14.02±1.6	14.04	0.05 NS
Post-Meal Min	12.05±1.29		

NS-Not Significant

Table – 2 Comparison of pre-Meal and Post Meal Sleep Latency in minutes of obese individual.

Group N=15	Mean± SD	Independent t value	P value
Pre-Meal Min	13.55±1.6	1.03	0.49 NS
Post-Meal Min	9.13±1.53		

NS-Not Significant

The sleep latency measured in obese individual before meal was 13.55±1.6 and 9.13 ± 1.53 after meal. There was no significant difference in the sleep latency measured before and after meal in obese individual (p value of 0.49).

Table-3 BMI, Pre-Meal and Post-Meal Sleep Latency Comparison in Obese Male and Obese Female individuals

Group N=15	Mean ± SD		t value	P value
	Obese Male	Obese Female		
BMI	26.67± 1.12	27.33±1.91	-0.79	0.44 NS
Pre Meal	13.38± 1.7	13.7±1.61	-0.38	0.71 NS
Post Meal	8.84±1. 61	9.39±1.53	-0.68	0.50 NS

Table 4 Comparison of BMI, Pre-Meal and Post-Meal Sleep Latency between non-obese male and non-obese female individuals.

Group N=15	Mean±SD		t value	P value
	Non-obese Male	Non-obese Female		
BMI	23.14±1.78	21.6±1.72	1.71	0.11 NS
Pre Meal min	13.94±1.96	14.1±1.35	0.19	0.85 NS
Post Meal min	11.91±1.55	12.17±1.11	-0.37	0.72 NS

Discussion

The primary finding of our study is that obese individuals even in the absence of sleep apnea or sleep disordered breathing have increased daytime sleepiness when compared to age and sex matched non-obese controls.

The pathophysiological mechanism of daytime sleepiness in obese individuals is unclear. Alexandros N Vgontzas et al., 1998 found that plasma levels of inflammatory cytokines (TNF α and IL-6) are elevated in disorders of excessive daytime sleepiness. They also demonstrated that TNF α and IL-6 were highest in obese patients with sleep apnea and there was a strong correlation between BMI and IL-6 levels. Plasma TNF α concentrations were significantly elevated in obese animals (Hotamisligil GS et al., 1993). Thus, cytokines play a role in mediating daytime sleepiness in obese individuals.

Obesity is a frequent causative factor of daytime sleepiness and fatigue. It is significant both in terms of occupational and social function as well as public safety. Obesity related daytime sleepiness could be associated with metabolic or circadian abnormality.

In the present study we have observed that as the BMI increased, there was a certain reduction in the onset of sleepiness. It was also observed that all subjects, irrespective of whether they were in the control group (Non-Obese subjects) or in the study group (Obese subjects) were sleepier (indicated by the earlier onset of sleep latency) after consuming meals (Post-meal) when compared with that of before consuming meals (Pre-meal)as in table1

The findings from the present MSLT study have shown that there is no increase in sleepiness of statistical significance within non-obese as well as within the obese subjects, both before and after the consumption of meal as in figure 2. However, in a study by Anita S. Well et al., 1998 has demonstrated that there is an increase in objective signs of sleepiness after the ingestion of meal and an apparent postprandial increase in sleepiness irrespective of the time of meal consumption. Further in the present study of sleepiness between nonobese and obese individuals there was no significant difference. Meanwhile our study does not suggest any correlation between gender difference and sleepiness. This provokes a thought that obesity alone cannot be considered to induce sleep.

Conclusion

Daytime sleepiness is a common, debilitating and potentially dangerous symptom, which is likely to be under-recognized. It can be caused by multiple contributors, usually interfering with sleep quantity and sleep quality.

In our study none of the obese patients were referred with a chief compliant of excessive daytime sleepiness or fatigue. Our study indicates that obese patients tend to underestimate the degree of their sleepiness. Thus self-reported sleepiness could be an underestimate of physiological state of sleepiness.

Clinicians should be aware of factors which put their patients at high risk of excessive daytime sleepiness, including shift work, obesity, depressive symptoms and poor sleep hygiene. Of these, further investigations of the hypothesized mechanisms by which obesity may cause excessive daytime sleepiness are of particular interest, due to the widespread prevalence of both of these conditions. Treatment should always focus on the underlying cause, promoting appropriate sleep quantity and quality by establishing good sleep hygiene. Available stimulant therapy may be used as an adjunct in certain cases. To optimize treatment of patients with excessive daytime sleepiness, it will be important to consider the wide range of unidentified risk factors which may be contributing to this symptom.

With the knowledge that consuming high glycemic index meal, 4hrs before bedtime promotes sleep can be used effectively in the treatment of sleep disorders such as insomnia. This can help reduce the side effects of medications. However, the effectiveness of the proposal needs to be explored.

Limitations

- This study could have been performed taking larger sample size in future for better results.
- The effect of meal size, various types of food on sleep has not been explored.

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Conflict of interest : Nil

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