

## Correlation of Obesity and Sleep Apnea in Adolescents and Its Impact upon Quality of Life

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### Abstract

**Background:** An intimate correlation occurs between obesity and sleep disorders among adolescence which has its impact on their overall performance and quality of life (QL). This study measures the degree of correlation between obesity and sleep apnea, and its impact upon QL and overall performance in Saudi obese adolescents.

**Methodology:** This case-control study has randomly included Saudi obese adolescents and eutrophic adolescents of both genders, aged 12-18 years. Instruments, which were used in the study, included a standardized and validated questionnaire. The questionnaires involved a sleep behaviour questionnaire and paediatric QL inventory. **Result:** A statistically significant correlation was seen between sleep disorders and obesity and an intimate impact upon their overall performance was also seen in the findings that included physical, emotional and social functioning. **Conclusion:** The study concluded that there is a great importance of improvements related to lifestyle and sleeping patterns among the Saudi population for reduced state of obesity.

**Keywords:** Sleep, adolescents, obesity, obstructive sleep apnea, quality of life.

### Introduction

Obesity is considered as a very common public health issue, which is affecting populations at the global level. It is a chronic medical condition, which can be defined as the excessive accumulation of fats in the human body (Turco et al., 2013; Al-Rethaiaa, Fahmy, & Al-Shwaiyat, 2010). Impaired balance between the expenditure and intake of energy is considered as a leading reason for this health issue. It means that the human body consumes more calories than it expends (Pulgarn, 2013; Heppenstall, Bunce, & Smith, 2012). There are several internal and external factors that playing a major role in the increased prevalence rate of obesity. These factors can include environmental factors, behavioural factors, socio-economic factors, hereditary factors, and cultural factors. A number of research based studies and nutritionists have shown certain factors related to the condition of obesity. Studies and natural history of most of the obese adolescents have indicated that the patients continue to gain weight since early childhood. Some of the health care professionals have also explained that the developments during early childhood will certainly result in the origination of obesity. Therefore, it is important to estimate and measure this serious medical problem on priority (Al-Hazzaa, Musaiger, Abahussain, Al-Sobayel, & Qahwaji, 2012; Neinstein LS, 2000). There is an increasing frequency of obesity related diseases, which have been reported in obese children and adolescents. The cases of obesity related disorders have been reported from both developed and developing countries (El Mouzan et al., 2010).

There is an increased prevalence rate of obesity in various different communities of the world (Fateme, Mohammad-Mehdi, Toba, Afsaneh, & Sharifzadeh, 2012). World Health Organization and observatory bulletin has mentioned that the obesity has increased incidence rate worldwide for over various years. Furthermore, the statistical investigation of the institutions has shown that global incidence rate of obesity has become twice, as compared to other decades (2000). It has been estimated from different reports that that 10% of the male individuals and 14% of the female individuals were found to be overweight by the year 2008 globally. However, the figures of obese individuals were around 8% for female individuals and 5% for male individuals by the year 1980. A recent study has described that the incidence rate of obesity is continuously increasing among the population of Saudi Arabia. The study has described that the average incidence rate of obesity, severe obesity, and overweight is 9.3%, 2%, and 23.1% respectively (El Mouzan et al., 2010). There are numerous factors, which can lead an individual towards the occurrence of overweight and obesity (Heppenstall et al., 2012; Al-Hazzaa et al., 2012; Pelegrini, Silva, Gaya, & Petroski, 2013). These factors include social, economic, and cultural habits as well as those factors, which are related to genetic disorders and endocrine diseases.

The alteration in lifestyles, lack of physical activity, tendency of overconsumption of fast food, reduction in food preparation at home, trends of excessive soft drink consumption, advances in technology, and invasion of computers are some extremely common causes of obesity (Al-Hazzaa et al., 2012; Pelegrini et al., 2013). Obesity is an epidemic disease (Heppenstall et al., 2012; Leske, Strodl, & Hou, 2012; Oduwole, Ladapo, Fajolu, Ekure, & Adeniyi, 2012), which leads to numerous serious complications and consequences on physical, psychological, social and behavioural aspects. Physical complications of obesity include type 2 diabetes mellitus, cardiovascular diseases, gallbladder diseases, renal diseases, stroke, hypertension, and metabolic syndrome (Al-Rethaiaa et al., 2010; Gilliland et al., 2003; Janjua, Mahmood, Islam, & Goldenberg, 2012; Leske et al., 2012; Nguyen, Magno, Lane, Hinojosa, & Lane, 2008; Pulgaron, 2013; Wijga et al., 2010). Psychological, social and behavioural consequences of obesity include low self-esteem, depression, isolation, nervousness and anxiety. All of these factors will directly affect patients' quality of life (Bjornelv, Nordahl, & Holmen, 2011; El Mouzan et al., 2010; Janjua et al., 2012). Among the different co-morbidities, which are associated with overweight and obesity, sleep disorders have a strong correlation (Lytle, Pasch, & Farbakhsh, 2011). Sleep disorders refer to the spectrum of medical conditions that leads an individual towards disturbance of sleep.

Every sleep disorder has its own complications and symptoms that are strongly associated with the mental, behavioural, and physical health of an individual. Sleep apnea is considered as one of the most serious types of sleep related disorders. Three types of sleep disorders have been identified, which include obstructive sleep apnea [OSA], central sleep apnea, and mixed type. OSA involves repetitive partial or complete cessation of airflow through the upper airways during night sleep, for more than 10 seconds. This condition has the capability to cause lack of sufficient sleep, and hinders the supply of oxygen. Moreover, this condition will also prevent the removal of carbon dioxide and therefore; will become life-threatening (Mirrakhimov, Sooronbaev, & Mirrakhimov, 2013; Prabhat, Goyal, Bey, & Maheshwari, 2012). Obstructive sleep apnea is strongly connected to the condition of obesity, and is considered as a major predisposing factor of obesity. This type of sleep disorder is usually seen in those individuals, having BMI higher than  $25\text{kg}/\text{m}^2$  and neck circumference greater than 16–17 inches, and who a habit of sleeping in supine position (Mirrakhimov et al., 2013). A significant number of studies have estimated that the incidence rate of obstructive sleep apnea is around 10% to 37% for the female individuals and 25% to 58% for the male individuals. In addition, the incidence rate of OSA is around 2% among middle aged female individuals and 4% of middle aged male individuals.

Among children, this type of sleep related disorder has shown a higher prevalence in the recent years; though, it remains lesser than adults (Young et al., 1993). Many serious and chronic epidemic medical problems have a direct influence over the quality of life and the daily performance of adolescents. Increasingly recognized co-morbidities, which are associated with obesity, are closely interconnected with the affected quality of life. Certain common co-morbidities include diabetes mellitus, ischemic heart disease, hypertension, dyslipidemia, osteoarthritis, and Obstructive sleep apnea (Al-Nuaim et al., 2012; Carter, III & Watenpaugh, 2008; Gilliland et al., 2003; Heppenstall et al., 2012). The incidence of obesity in adolescence is incessantly rising globally. The population of Saudi Arabia is also getting extremely prominent to this public health issue (El Mouzan et al., 2010). Obesity's correlation with sleep disorders has resulted in impaired life quality, which includes physical, emotional, and social activities. Unfortunately, this correlation has not been studied earlier among the population of Saudi Arabia, particularly in adolescents.

Therefore, the purpose of this study is analysing and comparing the association between sleep apnea [OSA] and obesity among obese adolescents. Additionally, the paper will also evaluate the impact of this relationship upon the quality of life in Riyadh, Saudi Arabia.

### **Methodology**

#### **Subjects**

The approach of comparative case-control study was used for the selection of obese and normal adolescents. The study involved obese and normal adolescents of both genders, aged from 12 to 18 years living in Riyadh, the capital of Saudi Arabia. The participants were recruited between the months of June and September, in the year 2013. The selected participants were classified into obese and normal categories, according to their Body Mass Index. The participants were chosen randomly from governmental and private schools; particularly, from those who belonged to middle socio-economic families. A consent form was collected from adolescents' parents before the start of investigation. The inclusion criteria for this study was to include obese adolescents having  $BMI \geq 30 \text{ kg/m}^2$  or  $\geq 95$  percentile and normal adolescents having  $BMI$  between  $18.5$  and  $24.9 \text{ kg/m}^2$  or 5th – 85th percentiles. On the other hand, the exclusion criteria for the study included those individuals, who were suffering from physical or mental disabilities, cardiac problems, or any chronic illness.

#### **Questionnaire**

Two validated and standardized questionnaires were distributed and applied to all the study participants [obese and normal adolescents]. The purpose of distribution of the questionnaires was to gather clinical and demographic data of the participants. Parents were asked to help their children in answering the questionnaires for accuracy, when needed. Sleep disorders were examined with the help of Sleep Behaviour Questionnaire [SBQ][30]. This questionnaire was used for the collection and gathering of data on various sleep behaviours and variables. The variables included nocturnal enuresis, parasomnias, sleep hygiene, daytime sleepiness, nocturnal awakening, snoring, and mood. SBQ contains 39 objects, which were graded from 1 [never] to 5 [always]. The final score range for this questionnaire was between 29 and 130. The worse quality of sleep was seen in higher SBQ score. Another questionnaire used in this study was the paediatric QL inventory [PedsQL™ 4.0 Generic Core Scales]. This questionnaire was used for the assessment of quality of life of adolescents' by evaluating their physical, mental, social, and school functioning. The summation of the mean score of these variables determined the psychosocial functioning score (Varni, Katz, Seid, Quiggins, & Friedman-Bender, 1998; Varni, Seid, & Kurtin, 2001).

#### **Anthropometric Assessment**

Research team was responsible for the measurement of body weight and height of every adolescent. Portable calibrated weight scale was used for the measurement of weight. Adolescents were asked to wear light clothing, and take off their shoes for accurate measurement. Body height was taken adjacent to 0.1 cm, using metric and non-elastic 2 meters measuring tape. BMI was calculated with the help of identified general formula. The general formula mentions that BMI can be achieved by the division of weight [kg] from the square of height [ $\text{m}^2$ ]. This formula can also be written as  $\text{kg}/\text{m}^2$ . Thereafter, the classification of participants was done with the help of BMI findings.

#### **Statistical Analysis**

The identified variables were statistically analysed for the proper assessment of characteristics related to both group subjects. The comparative analysis between obese and normal adolescents was performed as well. SPSS version 20 and different statistical software were used to evaluate the data after collection.

#### **Results**

One hundred and sixty [160] adolescents were recruited for the study over a time period of one month. Out of total recruited participants, 49.3% were boys and 50.62% were girls. The BMI was calculated among both the males and females. There were more obese boys [23.12%] as compared to girls [1.25%] while on the other hand, 24.37% of females were overweight as compared to only 2.5% males being overweight. The number of adolescents having normal weight was almost the same as mentioned in Table 1. When asked about the participant's sleep hours and sleep pattern, it was observed that most of the recruited adolescents [obese and normal] took one to two hour nap during the day.

Moreover, they slept late on both weekdays and weekends except individuals, aged from 12-15 years old. One of the adolescents was a smoker, and two adolescents were using medications. Statistically, table 2 is showing significant difference [ $p \leq 0.05$ ] in sleep quality between the obese groups compared to the normal, but only among the boys group. A difference was seen among the females group as well, but was not statistically significant. Among the girls, a clear distinction [ $p \leq 0.05$ ] was present between obese and normal groups, having the impaired QL on the PedsQL. Impaired quality of life was affecting almost all of the functioning domains as well as overall QL as shown in Table 3. Table 4 shows a major difference between the obese and normal group with the impaired QL on the PedsQL affecting almost all the functioning domain as well as overall QL among the obese boys.

## **Discussion**

Obesity is a very common chronic medical condition that results in a broad spectrum of physical, psychological, social and behavioural disturbances in adolescences (Al-Rethaiaa et al., 2010; El Mouzan et al., 2010; Heppenstall et al., 2012; Janjua et al., 2012; Turco et al., 2013). Another problem that affects the health and well-being in an adolescent is inadequate sleep (Turco et al., 2013). Both of these problems are known to be inter-related disorders, which ultimately affect the quality of life (Al-Hazzaa et al., 2012; Turco et al., 2013). Several published studies elucidated an increased prevalence rate of obesity among adolescent population in Saudi Arabia. This is also corroborated by the study, which showed increased prevalence of obesity in boys [23.12%] as compared to girls [1.25%]. However, prevalence of overweight was higher in girls 24.37%, as compared to 2.5% in boys, among the participants. This is likely to be attributed to the significant lifestyle changes witnessed in Saudi Arabia in the last decades. Common identified life styles include decline in physical activities, increased tendency towards fast food consumption, and sedentary behaviour due to the invasion of computer and videogames (Al-Nuaim et al., 2012; Turco et al., 2013). In relation with other investigations (Carter, III & Watenpaugh, 2008; Lytle et al., 2011; Turco et al., 2013), the study clearly identified the presence of notable difference between two groups related to sleep quality. It was noticed that both the genders had disturbed sleep behaviours with shorter sleeping hours per day, despite the naps they tend to take. The explanation for this statement might be related to their tendency for late sleep in both weekdays and weekends. These factors are likely to be contributing to the cause of the increased incidence rate of sleep disorders; therefore, impaired sleep quality in the obese and overweight groups, in comparison to the normal group.

The observed difference between the two genders in this study might also be contributed to the tendency of staying up late at night. The reasons for late sleep were found to be watching television as well as playing video games, particularly observed in male group. The influence of short sleep duration on food behaviour, leads to more consumption of lipids and carbohydrates. Thus, it will alter the equilibrium between energy expenditure and energy intake. Impaired equilibrium will eventually tempt to a positive energy balance that will lead to obesity and its co-morbidities, which is documented in several previous studies (Flatt, 2004; Tremblay, Plourde, Despres, & Bouchard, 1989; Turco et al., 2013). Despite this diversity, our study showed mild differences in food behaviour between the two groups. It was more obvious in the obese/overweight, when compared to the normal participants, but did not reach statistical significance. A noteworthy relationship was present between obesity and impaired quality of life [QL] among male obese adolescents on the PedsQL as compared to the normal group. Impaired quality life directly affected the behavioural, social, and physical functioning domains with overall QL having  $p$  value  $\leq 0.05$ . These results corroborated the findings reported in a well-known investigational study.

The study discussed the relationship between psychological disorders, social problems, & emotional issues, and their effect upon weight gain process & sleeping problems. The physical domain varied in the group with obesity, in comparison to the normal one in both genders [ $p \leq 0.05$ ], which drastically influenced overall QL. This was in concordance with results of previous studies, which documented that alteration in life styles will increase the prevalence of obesity. Moreover, sedentary life style and eating disorders are two important alterations in the life style (Wang, Monteiro, & Popkin, 2002). It further demonstrated a direct proportional relationship among obesity, impaired school performance, and cognitive functioning. All of these factors have been identified by various previous studies (Rocha, Rossini, & Reimao, 2010). Obesity is a serious medical condition, which has the ability of affecting major and minor health related aspects of the adolescents. This health issue has enough capability to make the individuals vulnerable through social isolation and discrimination. Moreover, sleep disorders also have a key role in the increased risk of obesity. Similarly, reduced physical activity can also lead an individual towards obesity. The condition of obesity is directly linked with memory loss, reduced attention, anguish, and depression.

Early diagnosis and the use of therapeutic approaches play an imperative role in the treatment of sleep disorders. The reason behind this statement is that sleep disorders have enough capability to increase the risk of obesity. Furthermore, lack of interventions will certainly result in the persistence of sleep related illnesses, during adulthood. Obesity is strongly connected with the increased frequency of sleep disorder and impaired quality of life. Studies have shown that affected sociability and self-esteem are two important factors that are associated with obesity (Johannsen, Johannsen, & Specker, 2006). There is a very common scenario, which illustrates a modern malaise regarding the increased burden of duties. It has been evaluated that increased burden will affect the concentration of parents over the children. Therefore, the families should use certain nutritional and outdoor interventions for the improved quality of mental and physical health. Also, proper health education program should be suggested to the adolescents and their families. These programs were aimed at the assessment and modification of health education and adopted lifestyles. It is also a fact that parents always play an extremely significant role in the education of families. Therefore, proper support and guidance are required for healthier leisure time choices and physical activities.

### **Ethical approval**

The study was endorsed by the IRB and ethics committee of the College of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia.

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### **Competing interests**

None declared.

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**Table 1: Characteristics of the participants**

Characteristics	Frequency [%]	
	Boys	Girls
Age [12-18yrs]	79 [49.37%]	81[50.62]
Body Mass Index [BMI]		
Normal weight [18.5-24.9]	38 [23.75%]	40 [25%]
Overweight [25-29.9]	4[2.5%]	39 [24.37%]
Obesity [30 or greater]	37 [23.12%]	2[1.25%]

**Table 2: Score of sleep behaviour was assessed by the Sleep Behaviour Questionnaire in both genders and groups.**

Gender	Obese / Overweight Mean/SD	Normal Mean/SD	*P-value
Girls	70.8 [18.5]	61.6 [7.9]	0.093
Boys	84.2[15.4]	63.7 [13.9]	P < 0.0001

\*Mann-Whitney's test; \*p<0.05; SD: standard deviation.

**Table 3: Peds Quality of life score over Quality of life domains in Girls**

Quality of life domains	Obese & Overweight [n=41] Mean/SD	Normal [n=40] Mean/SD	*P-value
School functioning	4.44 [3.0]	2.63 [2.0]	0.004
Social functioning	3.83 [2.6]	1.30 [1.0]	P < 0.0001
Emotional functioning	5.85[3.8]	3.44 [2.3]	0.011
Physical functioning	6.0 [3.9]	2.78 [2.2]	P < 0.0001
Overall quality of life	20.12 [12.2]	10.13 [5.2]	P < 0.0001

\*Mann-Whitney's test; \*p<0.05; PedsQL™ 4.0 Generic Core Scales.

**Table 4: Peds Quality of life score over Quality of life domains in Boys**

Quality of life domains	Obese& Overweight [n=41] Mean/SD	Normal [n=38] Mean/SD	*P-value
School functioning	6.03 [3.2]	2.79 [1.8]	P < 0.0001
Social functioning	4.73 [2.8]	1.95 [2.1]	P < 0.0001
Emotional functioning	6.70[3.4]	3.21 [1.3]	P < 0.0001
Physical functioning	7.28[3.5]	3.29 [3]	P < 0.0001
Overall quality of life	24.73[11.4]	11.24 [7]	P < 0.0001

\*Mann-Whitney's test; \*p<0.05; PedsQL™ 4.0 Generic Core Scales.