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Effect of Obesity on the Pulmonary Functions of the Adolescents

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Abstract ***Objective:*** To explore the effect of obesity on the pulmonary function of adolescents. ***Methodology:*** This study was conducted at Riyadh Colleges of Dentistry and Pharmacy (RCsDP), Saudi Arabia, during the period from January 2013 till April 2014. A simple random sample of 200 adolescent students were assessed. Three study questionnaires were used for data collection, i.e., personal characteristics questionnaire; case-finding questionnaire and the Medical Research Council (MRC) Dyspnea Scale. Spirometry was performed onto the participants, using Spirolab III machine. ***Results:*** Age of participants ranged from 17 to 19 years. Prevalence of overweight and obesity were high among adolescent students (30% and 22.5%, respectively). Body mass index correlated negatively and significantly with average FVC and average FEV_1/FVC (-0.129, p=0.035 and p=-0.217, p=0.001, respectively). ***Conclusions****:* Obesity may have a negative effect on pulmonary function of male adolescents. Weight loss is recommended to prevent the possible negative impact of obesity on pulmonary function of adolescent males.

Keywords Obesity, Pulmonary Functions, Adolescents

1. Introduction

Obesity is one of the risk factors that are responsible for many diseases and disorders that include myocardial infarction, congestive heart failure and metabolic disorders. It has been reported that in the United States, the prevalence for obesity from 1976 to 1980 and from 1988 to 1994, has significantly increased [1]. In addition, results collected over a period of 46 years, from 1960 to 2006, have shown that the percentage of men and women affected by obesity ranged from 10-34% and from 15-36% respectively [2].

The National Heart, Lung and Blood Institute in 1998 reported that overweight and obesity have been shown to cause sleep apnea and other abnormal respiratory conditions. A significant decrease in functional residual capacity (FRC) and expiratory reserve volume (ERV) has been reported in obese patients. Increased body mass index (BMI) has been reported to raise pulmonary arterial pressure [3].

Childhood obesity has been shown to be a predictor of adulthood obesity, and obesity-related complications, such as cardiovascular diseases and metabolic disorders [4]. A high BMI in a child could significantly contribute to obesity, which might augment as the child keeps on growing up. The incidence of obesity among adolescents has moved toward the higher side over the last three decades [5].

The increasing prevalence of childhood obesity is due to social changes. Unlike most adults, children and adolescents cannot choose the environment in which the food they eat and live. They also have a limited ability to understand the long term consequences of their behavior. Therefore, they need special attention in the fight against the obesity epidemic [6, 7].

In Saudi Arabia, several studies explored complications of obesity. Mosli et al. [8] reported that obesity is associated with metabolic disorders, while Habib [6] found that prevalence of obesity was also accompanied by poor fitness, whereas Al-Rethaiaa et al. [7] noted that 18-24 year old male college students were shown to have high BMI levels between the classes of overweight and obesity. However, the impact of obesity on pulmonary function of adolescents remains to be explored.

Therefore, this study aimed to explore the effect of obesity on the pulmonary function of adolescents.

2. Methodology

A cross-sectional study design has been followed. The study was conducted during the period from January 2013 till April 2014. The study was carried out at the Riyadh Colleges of Dentistry and Pharmacy (RCsDP), Riyadh City, Saudi Arabia.

Thre data collction tool comprised three parts, i.e., a "personal characteristics" questionnaire; and a

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"case-finding" questionnaire (which were constructed by the researchers), in addition to the "Medical Research Council dyspnea scale" [9].

The sample size for the present study was determined using "GPower" software to be 200 subjects. A simple random sample was followed to include 200 students (aged 17-19 years) in this study. Subjects with associated chronic diseases co-morbidities (e.g., diabetes, hypertension, renal or heart disease) were excluded.

Weight and height of each participant student were measured. Each student's BMI was calculated as his weight (in kg) divided by his squared height (in m^2) [10]. BMI values were correlated with FEV_1, FVC and FEV_1/FVC to test any significant correlation between obesity and pulmonary function parameters.

Spirometry was applied to all participants using the Spirolab III machine. Common measurements included:

- Forced Expiratory Volume for the 1st second (FEV_1): volume of air forced out in one second [11].
- Forced Vital Capacity (FVC): volume of air forced out after maximum inhalation.
- The ratio between FEV_1 and FVC (FEV_1/FVC) [11].

Spirometry was performed three times for each participant student. FEV_1 and FVC readings were also compared as a percentage of their predicted values (%FVC and %FEV_1, respectively). The mean values of the three readings for FEV_1, FVC, FEV_1/FVC, %FVC and %$FEV_1$for each student were calculated.

The statistical analysis for collected data was carried out using the Statistical Package of Social Sciences (SPSS) version 21. Descriptive statistics (i.e., frequency and percentage) were calculated. Pearson's correlation coefficients between BMI and variables of pulmonary function tests were calculated. P-values less than 0.05 were considered as statistically significant.

3. Results and Discussion

Age groups of participant students are shown in Table (1). All participants belonged to the late adolescence age period (i.e., 17-19 years).

Table (1). Age of Respondents

Age (in years)	Frequency	Percentage
17	23	11.5
18	119	59.5
19	58	29.0
Total	200	100

Table (2) shows that more than half of students (52.5%) were either overweight or obese (30% and 22.5%, respectively). This high prevalence of obesity among the study sample is in agreement with that of Al-Rukban [12], who stated that obesity constitutes an important public health problem among male adolescents in Riyadh. He reported that the prevalence of overweight among male adolescents was 13.8% and obesity was 20.5%. El-Mouzan et al. [13] reported that the prevalence rates for overweight and obesity among a national sample of 19,317 healthy children and adolescents in Saudi Arabia was 23.1%, and 11.3%, respectively. Moreover, Memish et al. [14], who conducted a nation-wide study that included 10,735 participants to assess prevalence of obesity in Saudi Arabia. They found that prevalence of obesity is 28.7%.

Table (2). Body Mass Index of Respondents

BMI	Frequency	Percentage
Underweight (16.0 - 18.4 kg/m^2)	7	3.5
Normal (18.5 – 24.9 kg/m^2)	88	44.0
Overweight (25 – 29.9 kg/m^2)	60	30.0
Obese (≥30 kg/m^2)	45	22.5
Total	200	100

Table (3). Correlation between BMI and variables of pulmonary function tests

Spirometry readings	Correlation coefficient	P-value
Average FVC	- 0.129	0.035
Average FEV_1	- 0.077	0.140
Average FEV_1/FVC	- 0.217	0.001
Average %FVC	0.094	0.092
Average %FEV1	0.049	0.247

The Pearson's correlation coefficients between BMI and measures of spirometry are described in Table (3). Significant negative correlations existed between BMI and both average FVC and average FEV_1/FVC (-0.129, p=0.035 and p=-0.217, p=0.001, respectively). Other correlations were not statistically significant.

Findings of the present study are in agreement with those of several studies. The study of Canoy et al. [15] correlated waist:hip ratio as an index of obesity with spirometry readings. They reported that both FEV_1 and FVC were linearly and inversely related across the entire range of waist:hip ratio. Jones et al. [16] reported significant inverse relationships between BMI and the values of pulmonary function tests. Koenig [17] stated that this is attributable mainly to pressing the diaphragm upwards due to the expanded abdominal volume of obese individuals.

4. Conclusions

Obesity may have a negative effect on pulmonary function of male adolescents. Weight loss is recommended to prevent the possible negative impact of obesity on pulmonary function of adolescent males.

REFERENCES

[1] Faria AG, Ribeiro MAGO, Marson FAL, Schivinski CIS, Severino SD, Ribeiro JD, Filho AAB. Effect of exercise test on pulmonary function of obese adolescents." Jornal de Pediatria, 2014; 90(3): 242-249.

[2] Paralikar SJ, Kathrotia RG, Pathak NR, Jani MB. Assessment of pulmonary functions in obese adolescent boys. Lung India. 2012; 29(3): 236–240.

[3] D'Andrea A, Naeije R, Grünig E, Caso P, D'Alto M, Di Palma E, Nunziata L, Riegler L, Scarafile R, Cocchia R, Vriz O, Citro R, Calabrò R, Russo MG, Bossone E. Echocardiography of the pulmonary circulation and right ventricular function: exploring the physiologic spectrum in 1,480 normal subjects. Chest. 2014; 145(5):1071-8.

[4] Kelsey MM, Zaepfel A, Bjornstad P, Nadeau KJ. Age-Related Consequences of Childhood Obesity. Gerontology 2014; 60(3):222-8.

[5] Davidson WJ, Mackenzie-Rife KA, Witmans MB, Montgomery MD, Ball GDC, Egbogah S, Eves ND. Obesity negatively impacts lung function in children and adolescents. Pediatric pulmonology 2014; 49(10): 1003-1010.

[6] Habib SS. Body composition analysis and estimation of physical fitness by scoring grades in Saudi adults. J Pak Med Assoc. 2013 Oct; 63(10):1285-9.

[7] Al-Rethaiaa AS, Fahmy AE, Al-Shwaiyat NM. Obesity and eating habits among college students in Saudi Arabia: a cross sectional study. Nutr J. 2010 Sep 19; 9:39. doi: 10.1186/1475-2891-9-39.

[8] Mosli HA, Mosli HH, Bokhari AA. The effect of obesity and components of metabolic syndrome on urinary and sexual functions in Saudi men. Res Rep Urol. 2013 Apr 19; 5: 91-7. doi: 10.2147/RRU.S43925. eCollection 2013. Mosli, et al., 2013).

[9] Stenton C. The MRC breathlessness scale. Occup Med (Lond) 2008; 58 (3):226-227.

[10] Mathers CD, Loncar D. Projections of Global Mortality and Burden of Disease from 2002 to 2030. PLoS Medicine 2006; 3 (11 e442): 2011-2030.

[11] Perez-Padilla R, Wehrmeister FC, Celli BR, Lopez-Varela MV, Montes de Oca M, Muiño A, Talamo C, Jardim JR, Valdivia G, Lisboa C, Menezes AM; PLATINO Team. Reliability of FEV_1/FEV_6 to diagnose airflow obstruction compared with FEV_1/FVC: The PLATINO longitudinal study. PLoS One 2013; 1;8(8):e67960.

[12] Al-Rukban MO. Obesity among Saudi male adolescents in Riyadh, Saudi Arabia. Saudi Med J. 2003;24(1):27-33.

[13] El-Mouzan MI, Foster PJ, Al Herbish AS, Al Salloum AA, Al Omer AA,Qurachi MM, Tatjana Kecojevicb T. Prevalence of overweight and obesity in Saudi children and adolescents. Ann Saudi Med. 2010; 30(3): 203–208.

[14] Memish ZA, El Bcheraoui C, Tuffaha M, Robinson M, Daoud F, Jaber S, Mikhitarian S, Al Saeedi M,. AlMazroa MA, Mokdad AH, Al Rabeeah AA. Obesity and Associated Factors — Kingdom of Saudi Arabia, 2013. Preventing Chronic Disease Public Health Research, Practice, And Policy Centers for Disease Control and Prevention 2014; 11 (E174): 1-10. Website:www.cdc.gov/pcd/issues/2014/14_0236.htm.

[15] Canoy D, Luben R, Welch A, Bingham S, Wareham N, Day N, Khaw KT. Abdominal Obesity and Respiratory Function in Men and Women in the EPIC-Norfolk Study, United Kingdom. Am J Epidemiol 2004;159:1140–1149.

[16] Jones RL, Nzekwu MM: The effects of body mass index on lung volumes. Chest 2006, 130:827-833.

[17] Koenig SM. Pulmonary Complications of obesity. Am J Med Sci 2001, 321:249-279.