

Effect of Smoking on Pulmonary Functions among Male Saudi Adolescents

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Abstract *Objective:* To estimate the current prevalence of cigarette smoking among Saudi male adolescents attending primary health care centers in Riyadh City, Saudi Arabia and its possible impact on their pulmonary function. *Methods:* The study followed a cross sectional design. Following a consecutive sample, a total of 388 Saudi male adolescents attending primary health care centers in Riyadh City, Saudi Arabia were included in this study. Spirometry was applied to all participants. Pulmonary function testing was performed. Common measurements included: forced expiratory volume for the 1st second (FEV₁); forced vital capacity (FVC) and the ratio between FEV₁ and FVC (FEV₁/FVC). Pulmonary function tests were performed three times for each subject. The average for the three readings was calculated. The percentages of predicted values for FVC and FEV₁ were calculated. *Results:* More than half of participants were overweight/ obese (56.7%). About one fourth of adolescents (25.8%) were smokers. Percent of predicted forced expiratory volume in first second (Mean±SD) was 59.1±11.8%. Percent of predicted forced vital capacity (Mean±SD) was 82.0±10.0 while the FEV₁/FVC ratio (Mean±SD) was 72.6±13.6. Prevalence of smoking was higher among older adolescents (28.9%) than younger adolescents (21.2%). Forced expiratory volume in first second (as % of predicted), forced vital capacity (as a percent of predicted) and FEV₁/FVC ratio were lower among smoker adolescent participants (p=0.044, p=0.761 and p=0.023, respectively). *Conclusions:* Prevalence of smoking among Saudi male adolescents is high. It starts mainly during early adolescence. There is a significant rapid decline in lung function among adolescent smokers as compared to non-smokers. Interventions to prevent tobacco use among adolescents are highly needed.

Keywords Smoking Pulmonary Physiology

1. Background

Cigarette smoking has been known to cause significant adverse effects on various organ systems, e.g., severe cardiovascular, cerebrovascular and pulmonary adverse effects. When a person smokes, the tobacco smoke passes through the nasal passage and reaches the alveoli. The tobacco particles get absorbed with other gases and diffuse in the respiratory passage and the alveoli. Various tobacco toxins spread to every site of the respiratory tract [1].

Cigarette smoking and its health consequences represents one of the most serious public health problems and represents an important health challenge worldwide [1]. Evidence is accumulating that smoking increases the risk of nearly all types of cancers and cardiovascular diseases [2]. In the last two decades, adolescents have become more exposed to tobacco promotion and marketing at early ages [3], and most smokers have reported that they began smoking before the age of 18 years [4-6].

Al-Rukban [7] stated that obesity constitutes an important public health problem among male adolescents in Riyadh. He reported that almost half of Saudi male adolescents have high body mass index. Al-Shehri et al. [8] demonstrated that overweight and obesity in Saudi Arabia is a serious public health problem, especially among adolescents. The prevalence is on the rise, and the need for interventions is becoming urgent.

Among the population aged 15 years or more in Saudi Arabia, approximately 37.6% of males are current smokers [3]. According to Bassiony [9], the prevalence of cigarette smoking among secondary school students is 12-29.8%, and among university students, it is 2.4-37%. Nevertheless, despite several published studies on smoking among Saudi adolescents, there is still a wide gap in literature about Saudi adolescent smoking [10].

Gold et al. [11] noted that, even in teenagers who have been smoking for few years, there is a measurable airway obstruction. It is believed that decline in pulmonary function tests is irreversible [12].

Canoy et al. [13] stated that obesity significantly impairs respiratory function. Al-Makadma and Moynihan [14] added that the initiation of smoking behavior during adolescence is associated with significantly negative effects on the

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respiratory system. Therefore, in a potentially obese population of Saudi adolescents, it is a pressing necessity to assess the impact of early smoking initiation on their respiratory function.

The present study aimed to estimate the current prevalence of cigarette smoking among male adolescents attending primary health care centers in Riyadh City, Saudi Arabia and its possible impact on their pulmonary function.

2. Methodology

The study followed a cross sectional design. Following a consecutive sample, a total of 388 Saudi male adolescents attending primary health care centers in Riyadh City, Saudi Arabia were included in this study. Collected data included personal characteristics (i.e., age and smoking status) and measures of pulmonary function tests (i.e., FEV₁ and FVC as percentages of predicted values and FEV₁/FVC ratio).

The duration of the study was 3 months i.e. from September to November 2014. The inclusion criteria were being Saudi, male adolescent (i.e., aged 10-19 years) [15]. Female adolescents were excluded from the study sample since prevalence of smoking among female adolescents has been reported to be negligible, i.e., 0.7% [16]. Moreover, patients with chronic diseases (e.g., diabetes, bronchial asthma) were excluded in the study.

Participants' height and weight were measured without shoes and wearing light clothes using digital scales and a portable stadiometer. Height and weight were measured to the nearest 1 cm and 0.1 kg, respectively. The body mass index (BMI) was calculated as weight (kg) divided by height squared (m²). According to the World Health Organization [17], participants aged 18 years and older, overweight and obesity were considered if BMI ≥ 25 kg/m². For participants aged under 18 years, BMI cut-offs for overweight and obesity were used, as defined by Cole et al. [18]. For the purpose of this study, participants' BMI classification was dichotomized into non-overweight or overweight/obese.

Spirometry was applied to all participants using the Spirolab III machine. Before testing, the required maneuvers were demonstrated by the researcher. Pulmonary function testing was performed using the acceptability standards outlined by the American Thoracic Society [19] with subjects in a standing position and wearing nose clips. Common measurements included: forced expiratory volume for the 1st second (FEV₁); forced vital capacity (FVC) and the ratio between FEV₁ and FVC (FEV₁/FVC). Pulmonary function tests were performed three times for each subject. The average for the three readings was calculated. The percentages of predicted values for FVC and FEV₁ 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. Tests of statistical significance

were applied (i.e., chi square and independent sample t-test). P-values less than 0.05 were considered as statistically significant.

3. Results

Table (1). Personal characteristics of study sample

Characteristics	No.	%
Age group		
• Early adolescence (10-14 years)	156	40.2
• Late adolescence (15-19 years)	232	59.8
Body mass index		
• Non-overweight	168	43.3
• Overweight/obese	220	56.7
Smoking status		
• Smoker	100	25.8
• Nonsmoker	288	74.2

Table (1) shows that 40.2% of participants adolescents aged 10-14 years, while 59.8% aged 15-19 years. More than half of participants were overweight/ obese (56.7%). About one fourth of adolescents (25.8%) were smokers.

Table (2). Measurements of pulmonary function (Mean \pm SD) among study sample

Measurement of Pulmonary Function	Mean \pm SD
Forced expiratory volume in first second as percent of predicted	59.1 \pm 11.8
Forced vital capacity as percent of predicted	82.0 \pm 10.0
FEV ₁ /FVC ratio	72.6 \pm 13.6

Table (2) shows that among participant adolescents, percent of predicted forced expiratory volume in first second (Mean \pm SD) was 59.1 \pm 11.8%. Percent of predicted forced vital capacity (Mean \pm SD) was 82.0 \pm 10.0 while the FEV₁/FVC ratio (Mean \pm SD) was 72.6 \pm 13.6.

Table (3). Distribution of smoking according to participants' stage of adolescence

Smoking status	Early adolescence (n=156)		Late adolescence (n=232)		p-value
	No.	%	No.	%	
Smoker	33	21.2	67	28.9	0.088
Nonsmoker	123	78.8	165	71.1	

Table (3) shows that prevalence of smoking among participant adolescents was higher among older adolescents (28.9%) than younger adolescents (21.2%). However, the difference was not statistically significant.

Table (4) shows that forced expiratory volume in first second (as % of predicted), forced vital capacity (as a percent of predicted) and FEV₁/FVC ratio were lower among smoker adolescent participants (p=0.044, p=0.761 and p=0.023, respectively).

Table (4). Pulmonary function measurements according to participants' smoking status

Measurement of Pulmonary Function	Smoker (n=100)	Nonsmoker (n=288)	P value
	Mean±SD	Mean±SD	
Forced expiratory volume in first second as % of predicted	57.1±14.4	59.8±10.7	0.044
Forced vital capacity as % of predicted	81.8±11.0	82.1±9.6	0.761
FEV ₁ /FVC ratio	69.9±13.7	73.5±13.5	0.023

4. Discussion

Adolescence is a critical period in the formation of smoking habits, with most smokers starting during their teenage years. Most persons who have smoked cigarettes on a daily basis reported having smoked their first cigarette before the age of 15 years [16].

The high prevalence of obesity among Saudi adolescents provides a baseline significant negative effect on their respiratory function. Therefore, this study aimed to assess the impact of early smoking initiation on respiratory function of male Saudi adolescents.

More than half of adolescent participants in this study were overweight/obese (56.7%). This high prevalence of obesity among male adolescents is in agreement with that of Al-Rukban [7], who reported that the prevalence of overweight among male adolescents in Riyadh City was 13.8% and obesity was 20.5%. El-Mouzan et al. [20] reported that the prevalence rates for overweight and obesity among a national sample of 19,317 healthy adolescents in Saudi Arabia was 23.1%, and 11.3%, respectively.

Results of this study showed that prevalence of smoking among Saudi male adolescents was as high as 25.8%. A similar high prevalence of adolescents' cigarette smoking was also reported in recent Saudi studies. In Riyadh, Saudi Arabia, Al-Ghobain et al. [2] and Al-Nohair [21] reported that prevalence of adolescent smoking was 31% and 29%, respectively.

This study showed that percent of predicted forced expiratory volume in first second (Mean±SD) was quite low (59.1±11.8%). This low value may be explained by the expected negative impact of overweight/obesity on respiratory function of adolescents. Canoy et al. [13] stated that FEV₁ is linearly and inversely related across the entire range of waist: hip ratio, as an index of obesity. Moreover, Jones et al. [22] reported significant inverse relationships between BMI and FEV₁. Joshi et al. [23] stated that, in males, the percentage of body fat showed negative correlation with FEV₁. Overweight and obese children showed 20% to 46% reduction in FEV₁ depending upon their degree of obesity.

Results of the present study showed that prevalence of smoking among adolescents did not differ significantly according to stage of adolescence. This finding indicates that

smoking mainly starts at early adolescence.

Studies report different ages at which children start smoking. Elders et al. [24] stated that the average trial for smoking is at the age of 14.5 years. Breslau and Peterson [25] found that 34% of children had their first cigarette at or before the age of 13 years, and another 43% initiated smoking between 14-16 years old. Jackson and Henriksen [26] reported that 21% of adolescents started smoking at the age of 10-11 years. The Centers for Disease Control and Prevention [27] indicated that only 8% had initiated use before the age of 11 years. Park [28] stated that many adolescents start smoking at a young age, out of curiosity and a spirit of adventure, only to become addicted to it.

This study showed that all measures of pulmonary function were lower among smoker adolescent participants. This finding is in agreement with those of reported by several studies. Abdalla et al. [16] noted that adolescents who smoke are more likely to have a variety of health problem, including upper respiratory tract infections, reduced lung growth and retardation of lung function.

Respiratory function tests indicate deterioration of respiratory function prior to the appearance of clinical symptoms, and their results can be used to prevent or reduce the incidence of respiratory diseases [29-30]. The rate of decline in lung function of smokers is rapid as compared to non-smokers [31].

In conclusion, the prevalence of smoking among Saudi male adolescents is high. It starts mainly during early adolescence. There is a significant rapid decline in lung function among adolescent smokers as compared to non-smokers. Interventions to prevent tobacco use among adolescents are highly needed.

REFERENCES

- Centers for Disease Control and Prevention. Health Effects of Cigarette Smoking. 2014. Retrieved from: http://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/.
- Al Ghobain, M. The prevalence of chronic obstructive pulmonary disease in Saudi Arabia: Where do we stand? *Annals of thoracic medicine*. 2011;6(4), 185.
- Barreiro E, Peinado VI, Galdiz JB, Ferre E, Marin-Corral J, Sanchez F, Barberà JA. Cigarette smoke-induced oxidative stress: a role in chronic obstructive pulmonary disease skeletal muscle dysfunction. *Am J Respir Crit Care Med*. 2010; 182(4), 477-488.
- Alexander C, Piazza M, Mekos D, Valente T. Peers, schools and adolescents cigarette smoking. *J Adolescent Health*. 2001; 29: 22-30.
- Warren CW, Jones NR, Peruga A, Chauvin J, Baptiste JP, de Silva VC, el Awa F, Tsouros A, Rahman K, Fishburn B, Bettcher DW, Asma S, Centers for Disease Control and Prevention (CDC) Global youth tobacco surveillance, 2000-2007. *MMWR Surveill Summ*. 2008; 57:1-28.

- [6] Lim HK, Ghazali SM, Kee CC, Lim KK, Chan YY, Teh HC, et al. Epidemiology of smoking among Malaysian adult males: prevalence and associated factors. *BMC Public Health*. 2013; 13:8.
- [7] Al-Rukban MO. Obesity among Saudi male adolescents in Riyadh, Saudi Arabia. *Saudi Med J*. 2003; 24(1): 27-33.
- [8] Al-Shehri A, Al Fattani A, Al Alwan. Obesity among Saudi children. Obesity among Saudi children. *Saudi J Obesity* 2013;1:3-9.
- [9] Bassiony M. Smoking in Saudi Arabia. Review article. *Saudi Med J*. 2009;30(7):876–81.
- [10] Al-Zalabani A, Kasim K. Prevalence and predictors of adolescents' cigarette smoking in Madinah, Saudi Arabia: a school-based cross-sectional study. *BMC Public Health*. 2015; 15: 17.
- [11] Gold DR, Wang X, Wypij D, Speizer FE, Ware JH, Dockery DW. Effects of cigarette smoking on lung function in adolescent boys and girls. *N Engl J Med*. 1996; 335:931-7.
- [12] Boskabady MH, Mahmoodinia M, Boskabady M, Heydari GR. Pulmonary function tests and respiratory symptoms among smokers in the city of mashhad (north east of Iran). *Rev Port Pneumol*. 2011;17:199-204
- [13] Canoy KD, 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. *Am J Epidemiol* 2004;159:1140–1149
- [14] Al-Makadma A, Moynihan M. Prevalence of Smoking Among Adolescents In Saudi Arabia: The Relationship To School Connectedness. *Arch Dis Child* 2014;99:A251-A252.
- [15] UNICEF. The Emerging Generation, Chapter 1. Adolescence: An Age of Opportunity. In: *The State of the World's Children* 2011, p. 6.
- [16] Abdalla AM, Al-Kaabba AF, Saeed AA, Abdulrahman BM, Raat H. Gender differences in smoking behavior among adolescents in Saudi Arabia. *Saudi Med J*. 2007; 28(7): 1102-8.
- [17] World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organ Tech Rep Ser*. 2000; 894(i-xii):1–253.
- [18] Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*. 2000;320(7244):1240.
- [19] American Thoracic Society. Standardization of spirometry: 1994 Update. Official Statement of American Thoracic Society. *Am J Respir Crit Care Med* 1995; 152:1107-36.
- [20] 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.
- [21] Al Nohair S. Prevalence of smoking and its related behaviors and beliefs among secondary school students in Riyadh, Saudi Arabia. *Int J Health Sci (Qassim)* 2011; 5(1):51–7.
- [22] Jones RL, Nzekwu MM. The effects of body mass index on lung volumes. *Chest* 2006; 130:827-833.
- [23] Joshi AR, Singh R, Joshi AR. Correlation of pulmonary function tests with body fat percentage in young individuals. *Indian J Physiol Pharmacol* 2008;52(4):383–8.
- [24] Elders MJ, Perry CL, Eriksen MP, Giovino GA. The report of the Surgeon General: Preventing tobacco use among young people (commentary). *American Journal of Public Health* 1994; 84(4), 543-547.
- [25] Breslau N, Peterson EL. Smoking cessation in young adults: Age at initiation of cigarette smoking and other suspected influences. *American Journal of Public Health* 1996; 86(2), 214-220.
- [26] Jackson C, Henriksen L. Do as I say: Parent smoking, antismoking socialization, and smoking onset among children. *Addictive Behaviors* 1997; 22(1): 107-114.
- [27] Centers for Disease Control and Prevention. Youth tobacco surveillance: United States, 1998- 1999. *Morbidity and Mortality Weekly Report*, 2000; 49(SS-10).
- [28] Park S. Smoking and adolescent health. *Korean J Pediatr* 2011; 54(10):401-404.
- [29] Miller MR, Hankinson J, Brusasco V, et al. Standardisation of spirometry. *Eur Respir J*, 2005; 26: 319–338.
- [30] Evans JA, Whitelaw WA. The assessment of maximal respiratory mouth pressures in adults. *Respir Care*, 2009; 54:1348–1359.
- [31] Kohansal R, Martinez-Camblor P, Agustí A, Buist AS, Mannino DM, Soriano JB. The natural history of chronic airflow obstruction revisited: an analysis of the Framingham offspring cohort. *Am J Respir Crit Care Med*. 2009; 180(1), 3-10.