Original article

Comparative study of Pulmonary Function tests in Tobacco chewers and non tobacco chewers

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Abstract

Introduction: Worldwide and in India also use of tobacco has got public health concern [1]. Main forms of tobacco use are smoking, chewing and snuffing in powder form. As per WHO report 100 million people were killed worldwide by tobacco smoking in the 20 [th] century and it is warned that it could kill one billion people around the world in the 21 [st] century [2]. Use of tobacco in forms other than smoking is called as smokeless tobacco (SLT) use. There is misunderstanding among people that tobacco chewing is least injurious to health. So present study was planned to find out any adverse effects of tobacco chewing on lung function.

 Methods: Pulmonary function tests (PFT) were carried out in 50 tobacco chewers and 50 healthy controls. Spirometric parameters studied were FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in one second), EFV1/FVC ratio, PEFR (Peak Expiratory Flow Rate), FEF.2-1.2 (Forced expiratory flow between 0.2 to 1.2 L of expiration, MMFER (Maximum mid expiratory flow rate) or FEF25-75 and MVV (Maximum Voluntary Ventilation).

Observations & Results: There was significant reduction in values of all PFT parameters in subjects compared to controls ($p<0.001$). Smokeless tobacco causes oxidative stress on lung airways leading to inflammation and obstruction. The reduction in values of pulmonary function test parameters in tobacco chewers suggests there occurs adverse effect on lung function by SLT use. So tobacco chewing habit should be quitted as a result of which further fall in lung function can be prevented.

Key words: Oxidative stress, Pulmonary function tests, Tobacco chewing

Introduction:

Use of tobacco has became topic of attention for researchers and public health policy makers worldwide. In India also use of tobacco has got public health concern[1].Tobacco is used in different ways. Main forms are smoking, chewing and snuffing in powder form. As per WHO report 100 million people were killed worldwide by tobacco smoking in the 20 [th] century and it is warned that it could kill one billion people around the world in the 21 [st] century [2]. Tobacco is used for burning and smoke is inhaled in form of bidis, cigarettes, hookahs, pipes[3,4]. Smoking of tobacco in any form is known to cause adverse health effects on respiratory system that includes chronic bronchitis, emphysema and bronchial carcinoma. This has been documented by various studies[5,6,7,8]. Use of tobacco other than in burning form is known as smokeless tobacco (SLT) use. Use of tobacco in this form is found to be increased rapidly throughout world especially

among youth. It is thought that it is safe alternative to smoking. Use of tobacco for chewing is one of the risk factors for development of local oral pre-cancerous conditions like lichen planus, leukoplakia, erythroplakia and cancers of mouth, throat, cheek, gum and lips [9]. Systemic effects of smokeless tobacco use include hypertension, angina, Reynaud's phenomenon [10]. But effects of this form of use of tobacco on lung function has not been studied well. In present study we studied whether chewing tobacco causes any adverse effects on lung function. In a study conducted in India in 2016, low values of pulmonary function tests among tobacco chewers were found compared to nonchewers [11]. But they had not considered all parameters of lung function tests. In present study we included all of them.

Aims & Objectives: 1) To study Pulmonary Function tests in tobacco chewers

2) To study Pulmonary Function tests in apparently healthy controls

3) To compare results between two groups

4) To find out type of disorder of lung function in tobacco chewers

5) To promote quitting of tobacco chewing

Material & Methods:

This was a Comparative study conducted in Department of Physiology of one of the teaching Medical institution in India. Subjects for the study were 50 tobacco chewers (males) working in the institution & voluntarily ready to participate in the study. Control group of 50 healthy age & sex matched non tobacco chewers, voluntarily ready to participate was selected for comparison.

Inclusion criteria were - Chronic tobacco chewers ready to participate in the study (subjects), Apparently healthy non tobacco chewers ready to participate in the study (controls)

Exclusion criteria were subjects with history of any major cardio respiratory disease, having oral lesions, endocrine disorder, smokers. The study was carried out in Department of Physiology of teaching Medical Institute in Western Maharashtra between April to September 2017.

All the participants were called in department for carrying out lung function test. Test was carried in morning hours between 10.00 am 12.30 pm. Tobacco chewing was quantified in pack years [10]. This was calculated as, Pouch years = No of pouches per day × years of chewing e.g. 1 pouch per day for 10 years = 10 pouch years. Depending on pouch years subjects were grouped into three: Group I(< 5 pouch years), Group II (5-10 pouch years) and Group III(>10 years). Informed written consent was obtained from all participants. Approval from Institutional Ethical Committee (IEC) was taken in advance before commencement of study. Anthropometric measurements like height and body weight were taken. Pulmonary function tests were carried out by using computerized Spirometry- "MEDSPIROR" (RMS Chandigrah, India). Each subject was shown a demonstration of the test before carrying out test. A minimum of three readings were recorded of each test performed on every subject and the best of the three was selected as final reading, for having reproducibility and validity of the recorded parameters. Pulmonary function parameters studied were FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in one second), EFV1/FVC ratio, PEFR (Peak Expiratory Flow Rate), FEF.2-1.2 (Forced expiratory flow between 0.2 to 1.2 L of expiration, MMFER (Maximum mid expiratory flow rate) or FEF25-75 and MVV (Maximum Voluntary Ventilation). The actual values of all tests were taken.

The data collected was summarized by computing mean and standard deviation (S.D.) of each study variable. Analysis was done by applying paired t test and one way ANOVA by using Instat 3 software. The difference was said to be significant if $p < 0.05$.

Observations and results:

There were 50 subjects who were chewing tobacco and 50 controls were taken who had no tobacco consumption. Table I depicts anthropometrical measurements. It was observed that there was no statistically significant difference between age of controls and subjects ($p > 0.05$).

Table I: Anthropometric measurements

Parameter	Controls Mean ± SD (n=50)	Subjects Mean ± SD (n=50)	p value
Age (yr)	37.76 ± 6.48	39.28 ± 10.66	> 0.05
Height(cm)	165.62 ± 7.10	161.86 ± 7.78	
Weight(kg)	64.26 ± 11.73	63.84± 9.45	

Out of 50 subjects 36 % had normal PFT findings, 42 % with mild obstruction, 8 % moderate obstruction, 2 % had severe obstruction and 12 % had restriction and obstruction together i. e. a mixed disorder.

In Table II comparison of values of various spirometric parameters between controls and groups of subjects is shown. It is observed that the values of almost all parameters were significantly reduced in all subject groups compared to those of controls. But the reduction in FEV1/FVC % was not up to statistically significant level.

Table II: Pulmonary function test values in controls and subjects

PFT parameter	Controls Mean ± SD (n=50)	Group I Mean ± SD (n=29)	Group II Mean ± SD (n=17)	Group III Mean ± SD (n=4)	P value Mean ± SD
FVC (L)	3.07 ± 0.30	2.60 ± 0.49	2.62 ± 0.50	2.53 ± 0.60	< 0.0001***
FEV1(L)	2.79 ± 0.36	2.34 ± 0.42	2.28 ± 0.38	2.15 ± 0.69	< 0.0001***
FEV1/FVC%	91.25 ± 5.55	89.87 ± 6.47	88.03 ± 8.60	83.71± 7.82	0.07
MVV (L)	119.22 ± 26.68	95.58 ± 27.40	96.17 ± 25.97	69.25 ± 14.36	< 0.0001***
FEF25-75(L)	3.68 ± 0.85	3.09 ± 0.87	2.79 ± 0.70	2.45 ± 1.44	0.0002***
FEF .2-1.2(L)	5.87 ± 1.56	4.97 ± 1.85	4.07 ± 1.47	4.19 ± 2.48	0.001**
PEFR (L/sec)	6.78 ± 1.61	6.12 ± 1.90	4.75 ± 1.64	4.38 ± 0.23	0.0007***

FVC -Forced Vital Capacity, FEV1- Forced Expiratory Volume in one second, EFV1/FVC ratio, MVV - Maximum Voluntary Ventilation, FEF25-75 -Forced Expiratory Flow between 25 % to 75 % of expiration, FEF.2-1.2- Forced expiratory flow between 0.2 L to 1.2 L of expiration, PEFR - Peak Expiratory Flow Rate

In Table III results of spirometric parameters in subject groups is shown. It is observed that there is progressive reduction in values of almost all parameters with increased duration of tobacco chewing but the reduction was not to the statistically significant level except that of PEFR value which had decreased to a significant level

Table III: Pulmonary function test values in different groups

PFT parameter	Group I (n=29)	Group II (n=17)	Group III (n=4)	P value
FVC (L)	2.60 ± 0.49	2.62 ± 0.50	2.53 ± 0.60	0.95
FEV1(L)	2.34 ± 0.42	2.28 ± 0.38	2.15 ± 0.69	> 0.05
FEV1/FVC %	89.87 ± 6.47	88.03 ± 8.60	83.71± 7.82	0.26
MVV (L)	95.58 ± 27.40	96.17 ± 25.97	69.25 ± 14.36	0.12
FEF25-75(L)	3.09 ± 0.87	2.79 ± 0.70	2.45 ± 1.44	0.28
FEF .2-1.2(L)	4.97 ± 1.85	4.07 ± 1.47	4.19 ± 2.48	0.23
PEFR (L/sec)	6.12 ± 1.90	4.75 ± 1.64	4.38 ± 0.23	0.02*

FVC -Forced Vital Capacity, FEV1- Forced Expiratory Volume in one second, EFV1/FVC ratio, MVV - Maximum Voluntary Ventilation, FEF25-75 -Forced Expiratory Flow between 25 % to 75 % of expiration, FEF.2-1.2- Forced expiratory flow between 0.2 L to 1.2 L of expiration, PEFR - Peak Expiratory Flow Rate

DISCUSSION:

Use of smokeless tobacco has increased worldwide. There is more prevalence of tobacco use in this form in Asian, African and Middle East countries. The ways of smokeless tobacco use include tobacco dipping, snuff, snus, tobacco gum, dissolvable tobacco, herbal smokeless tobacco, etc[12]. Chewing tobacco is the most popular form of smokeless tobacco use in Asian countries like India. Several adverse health effects have been attributed to smokeless tobacco[13,14,15]. Nicotine a harmful chemical present in smokeless tobacco has addictive properties making it harmful similar to smoking [15]. There is association between tobacco chewing and oral cancer, hypertension, heart disease and other conditions[16]. Respiratory system is also likely to be affected by it. In this study we also found affection of respiratory system in tobacco chewers. Out of 50 subjects 36 % had normal PFT findings, 42 % with mild obstruction, 8 % moderate obstruction, 2 % had severe obstruction and 12 % had restriction and obstruction together i. e. a mixed disorder.

In tobacco chewers there was reduction in all the PFT parameters including FVC, FEV1,FEF25-75, FEF.2-1.2,PEFR and MVV compared to controls. The reduction was statistically significant (p< 0.001). There was also reduction in FEV1/FVC ratio but it was not up to statistically significant level. Similar findings were found by other studies [17,18]. Smokeless tobacco causes imbalance between formation of reactive oxygen species and antioxidants leading to oxidative stress and chronic airway limitation [19].The free radicals alter the cellular antioxidant defence system. A study had found the release of free radical nitric oxide (NO) from extracts and components of smokeless tobacco in human saliva of SLT users[20]. Other study workers have reported oxygen free radical(O_2^-) production in cells exposed to smokeless tobacco and nicotine [20,21,22,23]. From Table 3 it is observed that there is progressive reduction in values of all PFT

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parameters with increased duration of tobacco chewing in terms of pouch years. But in our result the reduction was not to a statistically significant level except that of PEFR reduction ($p<0.05$). This may be due to few number of subjects in Group II and Group III compared to Group I. It is well documented that smoking of tobacco has adverse effects on lung function leading to COPD, brochogenic carcinoma, etc. Use of smokeless tobacco has also adverse effects on lung function. It causes oxidative stress leading to number of lung disorders like inflammatory, obstructive and fibrotic lung diseases [24]. The decrease in lung function in tobacco chewers evident from spirometric findings in our study may be due to increased oxidative stress. A large scale study may throw more light on this. As tobacco chewing has adverse effect on lung function quitting of tobacco was promoted by doing counselling of these people. So that further deterioration in lung function may be avoided.

Conclusion:

Use of tobacco in any form has adverse effects on body function. Smokeless tobacco use in form of chewing also affects lung function. Chronic tobacco chewing results in obstructive, restrictive or mixed type of lung disorder.

References:

1.Pramanik P. Effect of khaini- a form of smokeless chewing tobacco on pulmonary functions. Indian J Physiol Pharmacol 2013;57(1): 84-6.

2. WHO Report: Tobacco could kill one billion by 2100. Science Daily, 2008,Aug: 24:71.

3. Yadav JS, Thakur S. Genetic risk assessment in hookah smokers. , Cytobios 2000; 101(397):101-13.

4. Sajid KM, Akhter M, Malik GQ. Carbon monoxide fractions in cigarette and hokah (hubble bubble) smoke. JPak Med Assoc 1993; 43:179-82.

5. Burrows B, Khudson RJ, Martha Jeline, Lebowitz MD. Quantitative relationship between cigarette smoking and ventilatory function. Amer Review Resp Dis 1977; Vol.115:195-205.

6.Pandya KD, Dadhani AC, Chandwani S. Effect of physical trainings, age, sex, posture and smoking on peak flow rates. Indian J Physiol & Pharmacol 1984; 28: 3-38.

7. Dhand R, Malik SK, Sharma PK. Long term effects of tobacco smoking: Results of spirometric study in 300 old men. Ind J Chest Dis And Allied Sci 1985; Vol.27:44-9.

8. Gosavi GR, Pisolkar RM, Deshkar BV. Forced vital capacity in smokers and non-smokers. Journal of indian Medical Association 1981; Vol.77;12:189- 91.

9.Williams NS, Bulstrode CJK, O'connell PR. Bailey's and Love's short practice of surgeory,26'th ed. Boca Raton: Taylorand Francis Group; 2013.

10.Al-ibrahim MS, Gross JY. Tobacco use. In: Walker HK, Hall WD, Hurt JW, editors. Clinical methods: the history, physical and laboratory examinations. 3rd ed.Booston: Butterworths 1990: 214-16.

11.Ahuja A, Uppe A, Nair G. Study of lung function in tobacco chewers. International Journal of Current Research.2016;Vol.8(7):34334-37.

12.Shazly BA and Rania ME. Effect of Smokeless Tobacco (Madgha) on Spirometry. Int. J. Adv. Biomed.2017,No.2(2): 35-37.

13.Critchley JA, Unal B. Health effects associated with smokeless tobacco: a systematic review. Thorax 2003; 58:435-43.

14. Pershgen G. Smokeless tobacco. Br Med Bull 1996;52: 50-57.

15. Piano MR, Benowitz NL, Fitzgerald GA, et al. On behalf of the American Heart Association Council on Cardiovascular Nursing. Impact of smokeless tobacco products on cardiovascular disease: implication for polocy, prevention and treatment. Ciculation 2010;122: 1520-44.

16. World Health Organization. WHO Report on Global Epidemic: Warning about Dangers of Tobacco Geneva. World Health Organization 2011.

17. Pramanik P. Effect of khani- a form of smokeless chewing tobacco on pulmonary functions. Indian J Physiol Pharmacol 2013;57(1):84-86.

18. Gupta G, Goyal K, Gupta R. Pulmonary Functions in Smokeless Tobac Users in Haryana. International J. of Health Sciences and research 2016; Vol.6(6):106-12.

19. Schunemann J, Freudenheim JL and Grant BJB. Epidemiologic evidence linking antioxidant vitamins to pulmonary function and airway obstruction. Epidemiol Rev 2001;23: 248-61.

20. Lam EWN, Kelly EE, Martin SM, Buettner GR. Tobacco Xenobiotics release nitric oxide. Tob induced Dis 2011;1(3): 207-11.

21. Bagchi M, Balmoori J, Bagchi D, Stohs SJ, Chakrabarti J, Das DK. Role of reactive oxygen species in the development of cytotoxicity with various forms of chewing tobacco and pan masala. Toxicology 2002;179:247-55.

22. Wetscher Gj, Bagchi D, Perdikis G, Bagchi M, Redmond Ej, Hinder PR, Glaser K, Hinder RA. In vitro free radical production in rat esophageal mucosa induced by nicotine. Dig Dis Sci 1995;40: 853-58.

23. Bagchi M, Balmoori J, Bagchi D, Ray SD, KUszynski C, Stohs SJ. Smokeless tobacco, oxidative stress, apoptosis, and antioxidants in human oral keratinocytes. Free Radic Biol Med 1999; 26: 992-1000.

24.Heffner JE and Repine JE. Pulmonary strategies of antioxidant defense. Am Rev Respir Dis 1989; 140: 531-34.