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Research Article

IMPACT OF SMOKING INTENSITY ON MUCOCILIARY TRANSPORT AND PHYSICAL ACTIVITY LEVELS: A COMPARATIVE STUDY

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ABSTRACT

This study aimed to investigate the effects of smoking intensity on mucociliary transport and physical activity levels, comparing smokers and non-smokers. A total of 52 current smokers and 30 healthy non-smokers were included in the examination. Succharin transit time (STT) in the mucociliary system, lung function, and smoking history were assessed in all participants. Results indicated no significant difference in STT between light smokers (15 cigarettes/day) and non-smokers, with both groups exhibiting similar mean transit times (9-11 minutes; $p = 0.8$). However, heavier smokers (>25 cigarettes/day) demonstrated prolonged STT compared to non-smokers. Additionally, there was no significant difference in daily step counts between smoker and non-smoker groups ($p > 0.05$). Further analysis revealed that physical activity levels (PADL), as measured by waist-worn pedometers over six days, did not significantly correlate with smoking history, pack-year index, or years of smoking among the general smoker group ($r = 0.23$; $p > 0.09$). However, among moderate and heavy smokers, there was a significant negative association between STT and PADL ($r = 0.55$; $p < 0.02$), indicating reduced mucociliary function in individuals with higher smoking intensity. In conclusion, moderate and heavy smokers exhibited impaired mucociliary function compared to light smokers and non-smokers, suggesting a detrimental effect of smoking intensity on respiratory health. These findings underscore the importance of considering smoking habits and intensity when assessing mucociliary transport and respiratory function.

Keywords: - Smoking intensity, Mucociliary transport, Physical activity levels, Lung function, Respiratory health

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INTRODUCTION

In smokers comparatively, smokers have impaired mucociliary clearance, according to studies. Nonsmokers are also known to have an improved immune system when they engage in moderate physical activity. It is not entirely clear how physical activity affects mucociliary transport, however, and conflicting results have been reported. While Olseni and Wollmer [5] observed no substantial changes in mucociliary clearance following exercise, Wolff et al.[4] found a slight increase. Since these studies focus only on acute (i.e. transient) responses to exercise, we don't know how the mucociliary system adapts to daily physical activity over time. According to the authors, no studies on smokers have yet been conducted on this issue, and these studies were conducted only in nonsmokers. Our study examined the relationship between mucociliary transport and PADL using healthy smokers and healthy nonsmokers.

METHODS AND MATERIALS

Study subjects and design

Before beginning a program designed to increase daily physical activity, 52 current smokers(Table 1) participated in an observational cross-sectional study.

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Volunteers also informed them about the project in addition to advertisements in newspapers, buses, and health centers. At the time of the initial interview, participants had to smoke, have normal lung function6, and be free of cystic fibrosis, bronchitis, immotile cilia syndrome, trauma or surgery to the nose, as well as chronic or recent upper airway inflammation. Dysfunction in the bones, nervous system, or muscles can interfere with the assessment of PADL. In spite of whether the subject While being assessed, he or she didn't quit or reduce smoking even though he or she intended to in the future. As a result of smoking or for some other reason, there was no need to administer any pharmaceutical treatment during the assessment period. To compare our findings with those of 30 nonsmokers (Table 1), we screened 30 participants who did not smoke. Both the group and the smokers had similar ages, genders, and body mass indexes.

There were three groups of smokers, according to the intensity of their consumption of cigarettes: Among the 17 smokers and the 22 nonsmokers, we evaluated light, moderate, and heavy smokers. All participants signed the consent form after discussing the study's objectives and procedures. Institutional Research Ethics Committee approval was obtained (007/07).

Protocol

A participant was interviewed and asked about their smoking history (number of cigarettes, daily cigarette count, pack/year index) before being examined for pulmonary function (spirometry), mucociliary transit time (Inhalation of carbon monoxide and saccharide transit time (COexh). Temperatures and relative humidity were controlled during the tests. An abstinence period of 12 hours was observed, followed by assessments between 8:00 and 10:00 a.m., as instructed by The previous evening's last cigarette is given an instruction sheet. The PADL (number of steps/day) of each participant was calculated by wearing a pedometer for six days.

Lung function assessment

A microcomputer connected to Spirobank-MIR (MIR, Italy) 3.6 was used to perform spirometry. ATR and ERS guidelines were followed when developing the technique. REFERENCE values were specific to Brazil's population.

Rutland and Cole described STT as an effective and reproducible method for measuring MCT.11,12 Subjects were seated, heads slightly extended. Under visual control, 5 grams of sodium saccharin were deposited 2 cm inside the right nostril. In minutes, it took for the first taste of sweetness to be perceived after the particle was placed in the mouth. No deep breathing, talking, coughing, sneezing, or sniffing was permitted. Maintaining the original position was instructed to the participants. Swallowing only a few times per minute should leave a sweet taste in the mouth. It was decided to stop the test once the subjects were unable to taste anything, then place sugars on their tongue and repeat the procedure on another occasion for determination of their perception of sugars. The experiment's participants were forbidden to take any prescription medication for at least 12 hours before the experiment, including anesthesia, analgesics, barbiturates, tranquilizers, antidepressants, alcohol, and caffeine.

Measurements of carbon monoxide exhaust (COexh)

Using a MicroCO Meter, Micro Medical Ltd., Rochester, UK, we electrochemically measured the amount of COexh produced by participants after 20 seconds of deep breathing. It was indicative of smoking when COexh levels exceeded 6 ppm.

Assessing the level of daily physical activity (PADL)

A Digiwalker SW200 (Yamax, Japan) was used to measure PADL levels. It is easy to use, small, and inexpensive. It is worn along the knee. Based on a previous study14, pedometers can accurately estimate an individual's step count over time using the model used in this study. People who are sedentary walk 5000 steps/day, those who are moderately active walk 5000 steps/day, those who are moderately active walk 5000-7999 steps/day, moderately active individuals walk 7500-9999 steps/day, highly active individuals walk more than 12,500 steps/day, moderately active individuals walk 10,000 steps/day, while moderately active individuals walk 5000-7999 steps/day.

A logbook was kept by each individual for six consecutive days (Sunday through Friday) in which they recorded the number of steps they took every day. In order to analyze the data, six days' steps were averaged per day.

Statistical analysis

We used GraphicPad Prism 3.0 (GraphPad Inc., San Diego, USA) for our statistical analysis. We used non-parametric statistics for each group, and results are expressed as medians (95% confidence intervals) because of the small number of subjects. Kruskal-Wallis tests were used to compare the three groups of smokers (Dunn's pos-hoc test). We used the Mann-Whitney test to compare nonsmokers to smokers in general. The Spearman coefficient was used to assess correlations. For all analyses, p 0.05 was considered statistically significant.

RESULTS

During the assessment, none of the 82 subjects were excluded (52 smokers and 30 nonsmokers). Table 1 shows the results. COexh levels were higher in all three

smoker groups than nonsmokers ($p < 0.05$). Among the groups, the number of steps taken/day did not differ ($p < 0.05$). All groups were classified as somewhat active to physically active according to the number of steps/day, but in general, all groups had different activity levels.

A comparison of light smokers and nonsmokers showed no significant difference in mucociliary transport times ($p = 0.8$). Heavy smokers had significantly longer STT values (13 [11-17] min and 13 [10-21] min, respectively), compared with light smokers and nonsmokers (p 0.02).

As smokers ($r = 0.05$; $p = 0.78$), STT had no significant relationship with steps per day (Fig. 1). In non-smokers ($r = -0.42$; $p = 0.02$), STT had a significant negative relationship with steps per day ($r = -0.55$; $p = 0.02$). It was not found that strong smokers are associated with moderate smokers ($r = 0.31$; $p = 0.15$) or that heavy smokers are associated with mild smokers ($r = 0.36$, $p = 0.23$).

It was no longer associated with STT among smokers in general when the pack-years index, years of smoking, and age were taken into consideration ($r = 0.13$; $p = 0.37$). Taking steps per day and the pack-year index ($r = 0.01$; $p = 0.92$), cigarette years ($r = 0.18$; $p = 0.22$), and age ($r = 0.03$; $p = 0.81$), had less than significant correlations, according to the study. Control group STT versus steps/day had a power of 0.42, whereas a power of 0.04 was determined for STT versus steps/day in smokers in general. Based on a power of 80% and a significance test of 0.05, this difference could be detected.

Discussion

There is a modest but significant association between PADL and mucociliary function in light smokers and nonsmokers, but not in moderate to severe smokers. According to these findings, moderate to severe smokers exhibited impaired mucociliary clearance, while light smokers had no impairment. It is cautionary to interpret these results as causally related to In the absence of correlations, mucociliary function cannot be determined.

In upper and lower airways, mucociliary transport is a primary defence mechanism that is affected by a variety of factors, including stress, exercise, and toxic exposure [15, 16]. Acutely (transiently) and chronically, MCT changes in response to physical exercise [17-19]. During exercise, adrenergic mediators are released into the system, [20] which stimulates the frequency of ciliary beats, [21, 22] resulting in better airway clearance. This idea is confirmed by several studies [23-25]. that demonstrate that exercise affects the function of the respiratory mucosa in two ways: mild-moderate exercise improves mucosa function, while strenuous exercise impairs it. Using regular levels of physical activity as a means of chronic adaptation was a novel discovery in our study. Regular physical activity may benefit the respiratory systems of light smokers, since their MCT behavior is similar to that of nonsmokers. Mucociliary function will be slow for smokers who suffer from impaired STT, regardless of whether they exercise or not, because tobacco consumption slows down the mucociliary system. There is no association between physical activity and MCT in these subjects, but they must reduce their smoking intensity to a great extent. Despite this, the design of the study does not strongly suggest a correlation between PADL and MCT. It is likely that the results will be similar because light smokers were exposed to less cigarette smoke. Compared to moderate and heavy smokers, the latter may have not suffered enough structural damage. It is possible that MCT may vary more with cigarette consumption than with smoking history and physical activity level in smokers, since STT is not correlated with age, pack/years, years of smoking, and pack consumption in smokers. Although detailed information about smoking habits and regular physical activity is lacking in this study, this hypothesis is consistent with those previously raised.

Its sample size is smaller than those found in other studies since the data were stratified by cigarette consumption. In this way, the study is limited in its ability to perform further sub-analyses. Even though the sample sizes were relatively small, stratification did provide useful results, such as light smokers versus moderate/heavy smokers. Future studies should include smokers and consumers of cigarettes at varying intensities. For clarity purposes, the authors chose to refer to saccharin transit time in minutes rather than seconds, as is sometimes done in the specialized literature.

CONCLUSION

There is evidence from this study that light and nonsmokers appear to have improved mucociliary function in comparison with smokers those who smoke moderately and heavily.

REFERENCES

1. Cohen NA, Zhang S, Sharp DB, Tamashiro E, Chen B, Sorscher EJ. (2009). Cigarette smoke condensate inhibits transepithelial chloride transport and ciliary beat frequency. *Laryngoscope.* 119(11):2269-74.
2. Stanley PJ, Wilson R, Greenstone MA, Macwilliam L, Cole PJ. (1986). Effect of cigarette smoking on nasal mucociliary clearance and ciliary beat frequency. *Thorax.* 41(7):519-23.

3. Gleeson M, Pyne DB. (2000). Special feature for the Olympics: effects of exercise on the immune system: exercise effects on mucosal immunity. *Immunol Cell Biol.* 78(5):536-44.
4. Wolff RK, Dolovich MB, Obminski G, Newhouse MT. (1977). Effects of exercise and eucapnic hyperventilation on bronchial clearance in man. *J Appl Physiol.* 43(1):46-50.
5. Olseni L, Wollmer P. (1990). Mucociliary clearance in healthy men at rest and during exercise. *Clin Physiol*, 10(4):381-7.
6. Rabe KF, Hurd S, Anzueto A, Barnes PJ, Buist SA, Calverley P. (2007). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *Am J Respir Crit Care Med.* 176(6):532-55.
7. Trosclair A, Dube SR. (2010). Smoking among adults reporting life- time depression, anxiety, anxiety with depression, and major depressive episode, United States, 2005---2006. *Addict Behav.* 35(5):438-43.
8. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A. (2005). Standardisation of spirometry. *Eur Respir J.* 26(2):319-38.
9. Pereira CAC, Sato T, Rodrigues SC. (2007). New reference values for forced spirometry in white adults in Brazil. *J Bras Pneumol.* 33(4):397-406.
10. Rutland J, Cole PJ. (1981). Nasal mucociliary clearance and ciliary beat frequency in cystic fibrosis compared with sinusitis and bronchiectasis. *Thorax.* 36(9):654-8.
11. Stanley P, MacWilliam L, Greenstone M, Mackay I, Cole P. (1984). Efficacy of a saccharin test for screening to detect abnormal mucociliary clearance. *Br J Dis Chest.* 78(1):62-5.
12. Andersen I, Camner P, Jensen PL, Philipson K, Proctor DF. (1974). A com- parison of nasal and tracheobronchial clearance. *Arch Environ Health.* 29(5):290-3.
13. Middleton ET, Morice AH. (2000). Breath carbon monoxide as an indication of smoking habit. *Chest.* 117(3):758---63.
14. Schneider PL, Crouter SE, Bassett DR. (2004). Pedometer measures of free-living physical activity: comparison of 13 models. *Med Sci Sports Exerc.* 36(2):331-5.
15. Nakagawa NK, Franchini ML, Driusso P, de Oliveira LR, Saldiva PH, Lorenzi-Filho G. (2005). Mucociliary clearance is impaired in acutely ill patients. *Chest.* 128(4):2772-7.
16. Stannard W, O'Callaghan C. (2006). Ciliary function and the role of cilia in clearance. *J Aerosol Med.* 19(1):110-5.
17. Elliott MK, Sisson JH, Wyatt TA. (2007). Effects of cigarette smoke and alcohol on ciliated tracheal epithelium and inflammatory cell recruitment. *Am J Respir Cell Mol Biol.* 36(4):452-9.
18. Cannon JG, Meydani SN, Fielding RA, Fiatarone MA, Meydani M, Farhangmehr M. (1991). Acute phase response in exercise. II. Associations between vitamin E, cytokines, and muscle prote- olysis. *Am J Physiol.* 260 6 Pt 2:R1235-40.
19. Nieman DC, Nehlsen-Cannarella SL. (1994). The immune response to exercise. *Semin Hematol.* 31(2):166-79.
20. Holmqvist N, Secher NH, Sander-Jensen K, Knigge U, Warberg J, Schwartz TW. (1986). Sympathoadrenal and parasympathetic responses to exercise. *J Sports Sci.* 4(2):123-8.
21. Devalia JL, Sapsford RJ, Rusznak C, Toumbis MJ, Davies RJ. (1992). The effects of salmeterol and salbutamol on ciliary beat fre- quency of cultured human bronchial epithelial cells, in vitro. *Pulm Pharmacol.* 5(4):257-63.
22. Olseni L, Midgren B, Wollmer P. (1992). Mucus clearance at rest and during exercise in patients with bronchial hypersecretion. *Scand J Rehabil Med.* 24(1):61-4.
23. Nieman DC. (2000). Special feature for the Olympics: effects of exercise on the immune system: exercise effects on systemic immunity. *Immunol Cell Biol.* 78(5):496-501.
24. Foster C. (1998). Monitoring training in athletes with reference to over- training syndrome. *Med Sci Sports Exerc.* 30(7):1164-8.
25. Mackinnon LT, Chick TW, van As A, Tomasi TB. (1987). The effect of exercise on secretory and natural immunity. *Adv Exp Med Biol.* 216A:869-76.

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