Original Article

Subtle Changes by Bio-Aerosol, Addiction & Height on Routine Spirometry in Workers of New Subzi Mandi, Karachi

Subtle Changes by Bio-Aerosol, Addiction & Height on Routine Spirometry

Muhammad Ali[1], Mohammad Saleh Soomro[1], Iftikhar Ahmed Siddiqui[2], Muhammad Usman[1], Ruqaya Nangrejo[1] and Qamer Aziz[1]

ABSTRACT

Objective: Comparison of Spirometric changes in workers of New Subzi Mandi Karachi with control. It was also consisting on Air sampling for detection of Microorganisms in subzi mandi & control area.

Study Design: Case control study

Place and Duration of Study: This study was conducted at the new Subzi Mandi Karachi & control area, more than 5 kms from Subzi mandi from August 2019 till Jan 2020 for a period of five months.

Materials and Methods: 100 controls of similar age & socioeconomic strata were included. Known COPD & asthma & cardiovascular disease were excluded. Chi square and independent t-test was applied. Four different media used to collect ambient organisms, allowed to proliferate on kits & detected in microbiology lab.

Results: Bacteria & fungi detected by us were more concentrated in Subzi mandi. From 245 individuals 145 cases while 100 controls. Smokeless tobacco abusers were found significant association in cases. Height was again found more in cases. The mean of spirometric parameters provided clues of present article & only Predicted FVC% has significant association between groups.

Conclusion: Bio-aerosol & smokeless tobacco abuse causes subtle changes on modern routine spirometry. Clue found subtle because workers were tall & had optimum BMI. Spirometric results of controls were far behind from ideal value of adult male because they had significantly raised association of smoking.

Key Words: Spirometry, Forced Vital capacity (FVC), chronic obstructive pulmonary disease(COPD), Bio aerosols

Citation of article: Ali M, Soomro MS, Siddiqui IA, Usman M, Nangrejo R, Aziz Q. Subtle Changes by Bio-Aerosol, Addiction & Height on Routine Spirometry in Workers of New Subzi Mandi Karachi. Med Forum 2021;32(11):68-71.

INTRODUCTION

New Subzi mandi Karachi is a whole sale vegetable & fruit market & is overcrowded. Major source of Bio aerosol & association with pulmonary dysfunction [1]. Spore-forming bacteria (especially gram-positive) after being aerosolized are possible of surviving in the atmosphere for long periods of time. On the other hand, even gram-negative bacteria are able to survive in the atmosphere for about 390 minutes; these organisms can multiply in bio aerosols[2]. According to WHO occupational lung diseases will be 3rd most common cause of death in near future & any big city can be contaminated [3].

1. Department of Physiology / Biochemistry[2], Baqai Medical University, Karachi.

Correspondence: Dr. Muhammad Ali, Senior Lecturer of Physiology, Baqai Medical University, Karachi.
Contact No: 0332-8810421
Email: muhammadali@baqai.edu.pk/ali5t@outlook.com

Received: June, 2021
Accepted: August, 2021
Printed: November, 2021

Due to decaying of vegetable waste, waterlogging, animal garbage, poor sanitary condition and mud, high amounts of organic waste are produced in and around the vegetable markets. Poor storage facilities and resources of dumping waste cause faeco-oral route leading to poorer hygienic conditions which further aggravate the problems [4]. A survey report that agricultural & vegetable market workers are prone to asthma even without risk of smoking & fungi are more virulent due to smaller size [5].

The effect of bio aerosols in vegetable market further lead to constriction of the bronchioles, fibrosis and permanent airway wall thickening [6]. Other attributions causing mild to moderate restrictive changes are mawa and gutka (smokeless tobacco). These may be involved in oxidative damage. For that reason, it is important for assessment of spirometry as much as possible [7]. Endotoxins in organic dust have been associated with deranged PFTs [8].

Workers of vegetable markets are observed to encounter frequent bouts of allergic rhinitis & hypersensitivity pneumonitis [9]. Inhalation of bio aerosols in air can either be through oral route i.e. mouth or through the nasal route, i.e. nose. Chances of inhalation depend upon aerodynamic diameter and particle's dimension, rate of breathing and movement of air around body [10]. Spirometry is the most common tool used for respiratory problems [11].

MATERIALS AND METHODS

Statistical formula applied while calculating sample size.

Micro biological tests for detection of K Pneumonae. From Indol test we confirmed that it is Enterobacteraecae. Vp (Vogous Proscure test) found negative means that it is some other species of Klabsiella. Then from Citrate test & MR (Methyl red) test we detect K Pneumonae.

Inclusion Criteria

- Male manual workers ranging in-between 18-60 years,
- 100 individuals in control group with similar age and socio-economic status working & living minimum five kilometers away from vegetable market,

Exclusion Criteria

- Females,
- Individuals with established lung (Asthma & COAD) & cardiovascular disease.

Method of Air Sampling: A total of 3 samples were taken from Subzi Mandi approximately 5 meters away from shops so that no shop or particular shop is specified while three samples from control area were taken (environment of less bio-aerosol concentration, i.e. ghazi goth). Samples were taken 2 meters above the ground for matching inspired air. For fungal growth, Sabourads dextrose agar (SDA) medium was used while for bacterial growth, blood, Nutrient & Mac-Conkeys agar media was used. Incubation was done through chocolate agar medium. Exposure time to air was 30 minutes.

Data Collection Procedure: After ethical approval and informed consent from cases and controls. Data collected, it consisted of cases & control history of occupation, respiratory symptoms and other medical history. For spirometry, electronic digital portable spirometer was used to measure 3 routine parameters. These were forced expiratory volume in 1st second (FEV1%), forced vital capacity (FVC%) and FEV1/FVC% calculated.

Data Analysis: For analysis of data, SPSS version 23.0 was used. Qualitative data was represented as frequency and percentages while quantitative data was presented as mean and standard deviation. To test for association in-between cases and controls, Pearson Chi-square test [12] was applied on qualitative data whilst on quantitative data, independent sample t-test [13] was applied. All test was applied keeping p-value of <0.05 as statistically significant.

RESULTS

Table No.1: Coagulase Negative Gamma Hemolytic Staphlococci (Staph Epidermidis & Staph Hemolyticus**)**

Sample Code	***C1,2 & 3**	***VM1,2 & 3**
***Cfu/m²**	**500**	**1200**
Hemolysis on blood agar	γ hemolytic +ive	γ hemolytic +ive
Coagulase test result	Coagulase -ve	Coagulase -ve

*C1, 2 & 3 are 3 are samples from 3 sites of control area, Ghazi Goth,
*VM1, 2 & 3 are sample from 3 sites of Subzi mandi,
*cfu/m^2 = Colony forming unit per meter square

Table No.2: Total bacterial load (Staphlococci, Streptococci & Pseudomonas sp:**)**

Sample Code	**C1,2 & 3**	**VM1,2 & 3**
(Cfu/m²)	**500**	**1200**

Nutrient agar used which allows the growth of even non-fastidious organisms.

Table No.3: Fungus Aspergillus niger

Sample Code	**C1,2 & 3**	**VM1,2 & 3**
Asp.niger	01 Large spreaded black mold colony	03,01 & 01 small spreaded black mold colony

Table No.4: Klebsiella Pneumonie

Sample Code	**C1,2 & 3**	**VM1,2 & 3**
K.peumoneae cfu/m²	01,03 & 05 respectively	06,04 & 00 respectively

All of above found more in concentration in Subzi mandi than in control area.

Table No.5: Age & Anthropometry in cases and controls included in the study (n=245)

Parameters	**Cases**	**Controls**	**p-value**
Age (Years)	31.9 ± 11.3	33.2 ± 14.3	0.43
Weight (Kg)	67.1 ± 15.0	64.5 ± 14.1	0.17
Height (cm)	164.8 ± 6.4	161.6 ± 6.1	<0.001
BMI (Kg/m²)	25.0 ± 5.0	25.2 ± 5.2	0.82

Note significant association in height

Table No.6: History of Smokeless tobacco abuse in cases and controls

History of addiction	**Cases**	**Control**	**p-value**
Naswar	54 (78.3%)	17 (65.4%)	<0.001
Gutka	10 (14.5%)	4 (15.4%)	
Mawa	5 (7.2%)	-	
Pan	-	5 (19.2%)	

Note significant association

Control group was indulged more in Smoking. I took history of "Pack years" (No: of packets of 20 Cigarettes per day x no: of years since smoking). In controls 53.77 ± 6.14 while in cases 36.68 ±3.42, p-value <0.001 i.e, significantly raised. Mean of 1st 2 parameters of spirometry of control, FEV_1 = Mild derangement & Predicted FVC% = low (Table 8) as regard ideal value of adult male is concerned & far behind the cut off value that denies obstructive pattern.

Table No.7: Mean comparison of Routine Spiro metric Parameters between Cases and Controls

Parameters	Cases (n=145)	Controls (n=100)	p-value
Predicted FEV1 (%)	76.5 ± 35.4	75 ± 25.8	0.73
Predicted FVC (%)	122.4 ± 74.7	90 ± 36.1	<0.001
Predicted FEV1/FVC %)	80.6 ± 41.7	74.2 ± 39.1	0.22

Table No.8: Interpretation of Routine Spirometry (Based on ATS/ERS Criteria). **Interpretation of means of spirometry of cases**

PATTERNS	
Obstructive (Limitation of expiratory airflow)	Restrictive (Decrease lung volumes)
FEV_1 (Decrease)	FEV_1 (Decrease)
FVC (Normal or Decrease) Above 135% denies the pattern	FVC (Decrease) Above 135% denies the pattern
FEV_1/FVC (Decrease)	FEV_1/FVC (Normal to Increase)
SEVERITY	
Criteria of Mild Obstruction	% Predicted Values of Routine Spirometry
Normal FEV_1 and FVC	80 - 120
MILD FEV_1 (Obstruction or restriction)	70 - 79
NORMAL FEV_1/FVC	70 (According to age group of present study)
FEV_1/FVC	Decrease in obstruction and Increase in restriction (Fibrosis)

DISCUSSION

We plan to record changes of routine spirometric parameters purely due to pathognomies of Subzi Mandi hence tried to keep similar mean of age, BMI & weight (Table 5) duration of working since years & hours of daily working were similar i.e, non-significant association (p-value > 0.05) between cases & control.

While taking history, I saw that frequency of respiratory complaints are related to period since working in Subzi mandi. i.e, cough, sneeze & sputum expectoration.

The bacteria and fungi detected in our study again usually cause **obstructive changes.**

FEV_1 % again in mild derangement (Table 7 and 8). This means there is air flow resistance/limitation in mid & small air ways. **FVC%** although slightly above normal limit (Table 7 & 8) but again far behind the cut-off value of clue towards initial obstructive changes. **Ratio of above 2 parameters** is moderately raised (Table 7 & 8). It is affected by age which in present study is upto 60. After exclusion of diseases it is a sign of fibrosis, chronic exposure to bio aerosol can cause fibrosis. More important is smokeless tobacco abuse (Table 6).

In our study there found significant difference (p-value < 0.05) in abusers of smokeless tobacco (Gutka, mawa, paan and naswar) found more in workers of subzi mandi than control (Table 6). The third parameter, Ratio of first 2 parameters i.e, Mean of Predicted FEV_1/FVC% is moderately elevated (Table 7 & 8) means a clue towards fibrosis, restrictive pattern. This factor causes local fibrosis in mouth first than spirometry.

The case group found taller i.e. having more body surface area than control i.e. significant difference (p<0.05) in height (Table 5). This factor most probably can affect result i.e. otherwise there will be significant association in FEV_1% and FEV_1/FVC% between cases and control and will match the previous Indian study [8]. It is established fact that spirometric parameters depend on body surface area. Calculation of value of **Height** that can affect spirometric parameters is very much bias. At last it is reported that increase in height of +1% can affect Predicted % values of spirometry from 0.9% - 40%.

Hence we discuss 2 primary/major factors that affect our result of spirometry (p-value) i.e, Smoking of controls (described in results) & Height of cases (discussed above in last para). There are 2 other secondary factors that can upset the values of parameters of spirometry i.e, **Physical activity** & obesity. The manual workers must have handle weight of few kgs: many times in a day which can affect the status of their respiratory muscles (more strong) [14], although I excluded professional loaders while doing spirometry. 2nd is **Optimum BMI.** Only 16% of workers were found obese. Hence we can't able to receive clear cut association in p-values of remaining 2 parameters i.e, 1st & 3rd. Or in other words effect of bio-aerosol on spirometry is masked by these factors.

There is another 3rd reason i.e. chronic effect of organic dust affects the spirometric parameters more in childhood. The effect is limited in adults [15]. In our study adolescent up to 18 were excluded.

Why other 2 parameters are not showing significant association, as already mentioned in result that control group was indulge more in smoking & clue is present in mean of all 3 parameters but this is not the subject of present article so I would not like to discuss here. Otherwise there will be significant association in FEV_1 & Ratio of both parameters as present in FVC%.

FVC is known to be most important Spiro metric parameter.

CONCLUSION

Hence present article gives following conclusions:-

1. Bio aerosol (Bacteria & Fungi identified in our study) are related to obstructive changes in air ways (clue provided by mild decrease in mean of FEV_1 of workers),
2. Abuse of smokeless tobacco is related to fibrosis, restrictive pattern on modern routine spirometry (clue provided by moderate elevation in Predicted FEV_1/FVC% of workers).
3. As we know case control study based on clear-cut association of p-value & I am talking about mean of spirometric parameters hence I used terminology of “subtle effect” in title. There are 2 primary & 2 secondary factors that affect spirometric parameters i.e,

A) Height of cases (Para 5 of Discussion),
B) Smoking in control (Describe in results),
C) For 2 minor factors see Para 6 of Discussion

Acknowledgement: We acknowledge all participants from Sabzi Mandi Karachi for their support throughout the study.

Author’s Contribution:

Concept & Design of Study:	Muhammad Ali
Drafting:	Mohammad Saleh Soomro, Iftikhar Ahmed Siddiqui
Data Analysis:	Muhammad Usman, Ruqaya Nangrejo, Qamer Aziz
Revisiting Critically:	Muhammad Ali, Mohammad Saleh Soomro
Final Approval of version:	Muhammad Ali

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Seaman DM, Meyer CA, Kanne JP. Occupational and environmental lung disease. Clinics Chest Med 2015;36(2):249-68.
2. Finkel OM, Castrillo G, Paredes SH, González IS, Dangl JL. Understanding and exploiting plant beneficial microbes. Current Opinion Plant Biol 2017;38: 155-63.
3. World Health Organization. WHO global coordination mechanism on the prevention and control of noncommunicable diseases: final report: WHO GCM. World Health Organization; 2018.
4. Moitra S, Puri R, Paul D, Huang YC. Global perspectives of emerging occupational and environmental lung diseases. Current Opinion Pulmonary Med 2015;21(2):114-20.
5. De Matteis S, Heederik D, Burdorf A, Colosio C, Cullinan P, Henneberger PK, et al. Current and new challenges in occupational lung diseases. Eur Respiratory Review 2017;26 (146):1-15.
6. Hoy RF, Brims F. Occupational lung diseases in Australia. Med J Australia 2017;207(10):443-8.
7. Goel A, Omar BJ, Kathrotia R, Patil PM, Mittal S. Effect of organic dust exposure on pulmonary functions in workers of vegeTablele market with special reference to its microbial content. Ind J Occupational Environmental Med 2018;22(1):45-8.
8. Lai PS, Hang JQ, Valeri L, Zhang FY, Zheng BY, Mehta AJ, et al. Endotoxin and gender modify lung function recovery after occupational organic dust exposure: a 30-year study. Occupational and Environmental Med 2015;72(8):546-52.
9. Yang IV, Lozupone CA, Schwartz DA. The environment, epigenome, and asthma. J Allergy Clin Immunol 2017;140(1):14-23.
10. Haig CW, Mackay WG, Walker JT, Williams C. Bioaerosol sampling: sampling mechanisms, bioefficiency and field studies. J Hospital Infection 2016;93(3):242-55.
11. Rasam SA, Apte KK, Salvi SS. Infection control in the pulmonary function test laboratory. Lung India: Official Organ Ind Chest Society 2015;32(4):359-6.
12. Eshan D. Mitra, Raquel Dias, William S. Hlavacek. Using both qualitative and quantitative data in parameter identification for systems Biology Models 2018;9(1):3901.
13. Ryabko B Ya, Stognienko VS, Shokin Yu I. A new test for randomness and its application to some cryptographic problems (PDF). J Statistical Planning and Inference 2004;123(2):365–376.
14. Das N, Verstraete K, Topalovic M, Aerts JM, Janssens W. Estimating Airway Resistance from Forced Expiration in Spirometry. Applied Sciences 2019;9(14):2842-55.
15. Olsho LE, Payne GH, Walker DK, Baronberg S, Jernigan J, Abrami A. Impacts of a farmers’ market incentive programme on fruit and vegeTablele access, purchase and consumption. Public Health Nutr 2015;18(15):2712-21.