AIR CONDITIONER USERS ARE MORE PRONE TO RESPIRATORY PROBLEMS.

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Abstract: Background and objective: Air conditioner use causes the inhalation of cold dry air leading to alteration in the pulmonary functions. The aim of study is to evaluate the effect of cold air on pulmonary functions in air-conditioned exposed group by FVC,FEV1,FEV1%,FEF25%,FEF50%,FEF75%,FEF25-75% **Methods:** The present study was carried out at Baroda medical college to study effect of air-conditioner use on people working in banks, multiplexes which were further divided into two groups of 30 each. A) Individuals who use AC. for 8 hrs daily B) individuals who use AC. for 12 hrs daily. Comparison group comprised of people working in similar work environment who are not exposed to air-conditioner. Pulmonary functions were measured with medspirometer (electronic spirometer). **Results:** The mean FVC for A.C users is 2.47 litres as compared to non a.c. exposed individuals (4.57). In a.c. users FEV1 (2.15±0.44), FEV1/FVC (87.62±11.57), FEF25 %(6.3±1.5), FEF50 %(2.74±0.54), FEF75 %(1.35±0.34), FEF25-75%-2.37±0.35. In non a.c. users FEV1(3.77±0.45), FEV1/FVC(87.62±10.52), FEF25%(7.44±1.03), FEF50%(4.80±0.90),FEF75%(2.34±0.62),FEF25-75%(4.25±0.57). **Conclusion:** The present study concludes that persons exposed to air-conditioner were found to have lower ventilatory functions as compared to other group. The effect was more in persons exposed to 12 hrs as compared to 8 hrs.

Key-words: Air conditioner, pulmonary functions, ventilatory functions.

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Introduction:

As a result of global warming, excessive pollution and changed life style, which are gifts of modernization our environment has changed. Nature has responded to these changes by increasing the temperature of our environment. So, because of increased environmental temperature air conditioners which provide cool air have become a necessity in these days. Air conditioner creates an artificial environment in the surroundings through which we breathe artificial cool air which is coming out of air-conditioner.

Inhalation of cold air for prolonged period of time makes the airways dry and the smooth muscle more sensitive. This activates thermo sensitive channels, TRPM8 expressed as airway afferent nerves which initiate response to cold dry air giving rise to autonomic response like bronchoconstriction, dyspnoea, cough and mucosal swelling. The new aspect about my study is that among air-conditioned exposed I have compared the duration among exposed individuals between 8 hrs. And 12 hrs.

Material and Methods:

The present study which is a prospective and cross-sectional study was carried out in the department of physiology, medical college Baroda, Gujarat after taking due permission from the institutional ethical committee. The study was carried out from July 2014 to July 2015.Total number selected were 120 males who were in the age group of 25-50 yrs, healthy non smokers and persons who were not having any respiratory symptoms. They were exposed to air-conditioner for a minimum period of 8hrs per day and 5 days a week for at least one year. Control group consisted of people working in similar work environment but not air-conditioned exposed. Persons having any respiratory symptoms like cough, sputum, dyspnoea, chest pain etc., history of asthma, allergic rhinitis, hay fever, urticaria, any other allergic condition, cardiac diseases and any other systemic illness and any person not willing to participate were excluded from the study.

Those participants who are satisfying the inclusion and exclusion criteria and were willing to participate were enrolled after taking written and informed consent .The study was conducted in the morning hours between 9-12 a.m. The participants were instructed to avoid heavy physical activities, abstain from tobacco, cigarette smoke and alcohol for at least 12 hrs before taking the readings and the subjects were advised to come two hrs after

light breakfast. The place to perform the study was the workplace of the participants. The subjects were divided into two groups. The subjects of first group were exposed to A.C. environment for 8 hrs per day for five days a week. The subjects of second group were exposed to a.c. environment for a period of more than 8 hrs & maximum exposure up to 12 hrs for at least 5 days a week. The first visit at the work place was for explaining the general instructions and procedural details to the subjects so that they become accustomed to the manoeuvre. The second visit involved the actual testing with spirometry.

Testing equipment-Lung functions were measured by medspirometer which is a computer based spirometer with a highly advanced and user friendly software offering 34 parameter readings, pre and post-bronchodilatation results, percentage improvement and lung age calculations.

Baseline spirometry: Participants were familiarized with the medspirometer which is a Portable spirometer and thoroughly demonstrated. PFT indices that will be recorded will be –

Forced vital capacity (FVC),Forced expiratory volume in 1st sec of expiration (FEV_1),Forced expiratory flow at 25% of vital capacity ($FEF_{25\%}$),Forced expiratory flow at 50% of vital capacity($FEF_{50\%}$)Forced expiratory flow at 75%of vital capacity($FEF_{75\%}$),Forced expiratory flow at mid half of FVC($FEF_{25-75\%}$),Ratio of FEV1/FVC.

Correct interpretations of spirometry requires that it is to be performed correctly to obtain an accurate recording, the subject should be told to

1. Stand or sit up straight.
2. Inhale maximally
3. Get a good seal around the mouthpiece of spirometer.
4.Continue exhale until he or she can blow no more in practice, this is when less than 50 ml has been exhaled over two seconds.
5. Exhalation should continue for at least six seconds and up to 15 seconds, if necessary, some patient will find these exhausting and prolonged manoeuvre should be used with caution.
6. Repeat until three technically acceptable manoeuvre (no cough, air leaks and false start) are completed.

Data obtained were entered in MS excel sheet and analysed using software med calc c. Students unpaired t test was used to compare the variables.

Result:

The results of present study showed in 60 subjects the mean percentage predicted value of FVC-2.47±0.44,FEV1-2.15±0.44,FEV1/FVC-87.62±11.57,FEF25%-6.3±1.5,FEF50%-2.74±0.54,FEF75%-1.35±0.34,FEF25-75%-2.37±0.35.These were statically analysed by unpaired t test.

Table: 1 Comparison of pulmonary functions between air conditioned exposed and non air conditioned exposed.

PARAMETER	A.C.EXP.		NON EXP.		t VALUE	P VALUE
	N=60		N=60			
	MEAN	S.D.	MEAN	S.D.		
FVC(L)	2.47	0.44	4.57	0.78	18.16	<0.0001*
FEV1(L)	2.15	0.44	3.77	0.45	19.93	<0.0001*
FEV1\FVC	87.62	11.5	83.2	10.52	2.20	=0.048*
FEF25%(L/S)	6.3	1.50	7.44	1.03	4.85	<0.0001*
FEF50%(L/S)	2.74	0.54	4.80	0.90	15.20	<0.0001*
FEF75%(L/S)	1.35	0.34	2.34	0.62	10.84	<0.0001*
FEF25-75%(L/S)	2.37	0.35	4.25	0.57	21.77	<0.0001*

*Statically significant

The pulmonary functions of two groups were statically analysed by unpaired t test. It shows as there is exposure to conditioned air, pulmonary function also changes. These observed differences among two groups were statically significant.

TABLE-2: Comparison of pulmonary functions between air conditioned exposed group with respect to duration of conditioned air.

PARAMETER	A.C.EXP.8 HRS.		A.C.EXP.12 HRS.		T value	P value
	N=30		N=30			
	MEAN	S.D.	MEAN	S.D.		
FVC(L)	2.53	0.42	2.41	0.47	0.47	0.30
FEV1(L\S)	2.17	0.43	2.13	0.45	0.45	0.35
FEV1/FVC	88.10	14.37	87.13	8.08	8.08	0.32
FEF25%(L/S)	8.63	2.12	4.14	0.40	11.39	<0.0001*
FEF50%(L/S)	2.95	0.50	2.53	0.51	8.08	<0.002*
FEF75%(L/S)	1.62	0.34	1.28	0.5	3.08	0.003*
FEF25%-75%(L/S)	2.49	0.35	2.25	0.31	2.81	0.006*

*Statistically significant

It shows that even with increasing duration of exposure to conditioned air FVC, FEV1, FEV1\FVC were not significantly different in the two groups. But the parameter FEF25%, FEF50%, FEF75% and FEF25-75% shows a significant change.

The mean values of FEF25%, FEF50%, FEF75%, FEF25-75% in the air-conditioned exposed group for 12 hrs, shows a decrease as compared to the air conditioned exposed group for 8 hrs, which is statistically significant. The percentage predicted values of these parameters show that they are much lower in the air-conditioned exposed group for 12 hrs as compared to 8 hrs.

Discussion: Respiratory diseases have become very common these days. It is the price of civilization one has to pay for. As advancements in technology is increasing day by day ,so is the use of machines for the comfort of human body .Air conditioner use has become an integral part of our working environment ,credit goes to increased temperature of the environment as a result of global warming.

Few studies have been conducted and are still continuing to understand the effect of air conditioner use on the outcome of respiratory diseases.

The results of the present study showed that A.C. Users are predisposed to respiratory dysfunction. It was revealed that increasing the duration of ventilation from 8-12 hrs.cause a significant fall in FEF25%, FEF50%, FEF75% and FEF25-75%.

The mean FVC in air conditioned exposed group(2.47±0.44) in our study which was statistically significantly($p<0.0001$) lower than non air conditioned exposed group 2.15±0.44 (Table-2)(Figure-1).Similar statistically significant result was not found in our study in between A.C. Exposed individuals who were exposed for a period of 8 hrs.(2.53±0.42)in comparison with 12 hrs (2.17±0.43).This is statistically non-significant as $p=0.42$.Cold air may induce respiratory symptoms by direct cooling and excissation of mucosal surface with subsequent hyper tonicity of superficial fluid layer and interactions between the trigeminal and vagus nerve at the central level. TRPM8, thermo sensitive channels expressed on airway afferent nerves, which initiates response to cold air, giving rise to autonomic responses like bronchoconstriction, cough, dyspnoea, chest tightness, mucus secretion and mucosal swelling.

Results were also obtained by Sabade[5]sb et al who during his study found significant decrease in FVC in air-conditioned exposed group (2.29±o.460) as compared to non air-conditioned exposed group (3.28±0.358).Similar results were also obtained by R.Babitha[4] et al which showed decrease in FEV1 in air-conditioned exposed group as compared to non air-conditioned exposed group (3.22±o.2).Different geographical areas will have different results due to difference in the environmental conditions. In our study mean of FEV1/FVC ratio in air-conditioned exposed individuals is (83.16±11.57) %which is statically significantly lowered than non air-conditioned exposed individuals (87.62±10.52) %. Similar results were not found in individuals when comparison of individuals who were exposed for a duration of 8 hrs. Are compared with that of 12 hrs.As the comparison of duration of 8 hrs with 12 hrs is done, we did not find any study till now which has compared the duration of air-conditioned exposed group.

LIMITATIONS OF STUDY- As the sample size was too small (n=60) in the present study, it cannot be

applied to general population. Further studies on a large sample size are indicated. Inclusion of various other parameters like duration of exposure to A.C, Velocity of cold air of A.C, Humidity of the environment and space to which the subjects are exposed may further help for in depth evaluation. We advice that further studies be carried out taking into consideration all these factors on a large sample size over a long period of time. Those persons who are customarily exposed to air conditioner like in work places should regularly have pulmonary function tests included in their regular health check-up's so that respiratory ailments which are constantly increasing these days be diagnosed at the earliest and treated accordingly .

Conclusion:

In our study 100% of air-conditioned exposed group were found to have lower ventilatory functions as compared to non air-conditioned exposed group.

Decrease in all parameters of forced expiratory spirogram was observed in individuals exposed to air conditioners as compared to individuals who are not exposed to air-conditioners. Further the reductions were more in the group exposed for 12 hrs as compared to 8 hrs. The findings are suggestive of obstructive pattern of airway disease. Using the pulmonary function testing in asymptomatic individuals in A.C. Exposed group one can uncover abnormal functioning of airways. This would have remained hidden if asymptomatic individuals have not been included in the study. Early detection of air-conditioned exposed changes in airway function and timely intervention may prevent the lifelong disability due to COPD.

Those persons who are customarily exposed to air conditioner like in work places should regularly have pulmonary function tests included in their regular health checkups so that respiratory ailments which are constantly increasing these days be diagnosed at the earliest and treated accordingly .

Message to community – As the temperature of the environment is increasing day by day, its really difficult to live without the use of air-conditioner. But we can minimize its use by constructing buildings which are airy and there is entry of lot of fresh air. Also,when we are not using the place which is airconditioned,the air conditioners should be switched off .Regular maintenance for cleaning of airconditioner should be undertaken,so that diseases which spread as a result of noncleaning of airconditioner can be prevented and environmental pollution may not occur.

Results:

In our study FVC,FEV1,FEV1\FVC,FEF25%,FEF50%,FEF75%and FEF25-75% were significantly lowered in A.C. Exposed individuals as compared to non A.C. Exposed individuals.($p<0.05$).Among the A.C. Exposed individuals those who were exposed for a period of 12 hrs.havestastically significant decrease in FEF25%,FEF50%,FEF75% and FEF25-75% as $P<0.05$.

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