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The Length of Cigarette Smoking is the Principal Risk Factor for Developing COPD

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ABSTRACT

Background: The deterioration in lung function associated with Chronic Obstructive Pulmonary Disease (COPD) is directly related to duration of smoking and the number of cigarettes smoked. Over 85% of lung cancers are attributed to smoking. The problem is, whether the length of smoking consumption period has more impact to COPD and lung cancer than the bigger number of cigarettes smoked per day?

Examinees and methods: The sample has constituted of two groups of examinees, smokers, both gender, age 25-64 years old. The first group consisted of 240 examinees divided in 8 subgroups according to a number of years they have been smoking. The second group consisted of 180 examinees, which was divided in 6 subgroups, according to average number of cigarettes smoked daily during the smoking consumption period.

Results: The prevalence of smoking was higher in men (65.7% vs. 62%) than in women (34.3% vs. 38%). Smoking duration in the group of smokers according to the length of smoking consumption period was 20.34 ± 10.63 y and in the group of smokers according to a number of cigarettes smoked daily 13.55 ± 8.20 y. COPD were registered as the most frequent lung disease, in the group of smokers according to a number of cigarettes smoked per day 52.2% and in the group according to the length of smoking consumption period 39.1%, and the middle values of FEV1 (82.77% vs. 97.64%), and FEV1/FVC (86.02% vs. 97.73%) were lower in the group of smokers according to a number of cigarettes smoked.

Conclusion: Chronic respiratory symptoms, impairment of lung function and diagnosis of COPD depended more on the length of smoking duration than a number of cigarettes smoked.

Keywords: cigarettes smoking, COPD, lung cancer, FEV1, FEV1/FVC

Introduction

Toxins in cigarette smoke alter the airways, alveoli and capillaries, and the immune system of the lung¹. Tobacco smoke contains chemicals in the form of particulate substances and gases². Tobacco smoking produces both mainstream smoke (drawn

through the tobacco column and exiting through the mouthpiece during puffing), and sidestream smoke (emitted from the smoldering tobacco between puffs). Sidestream smoke and mainstream smoke contain many of the same chemical constituents, including at least 250 chemicals known to be toxic or cancerogenic³.

COPD is a respiratory disorder largely caused by smoking, and is characterized by progressive, partially reversible airway obstruction and lung hyperinflation, systemic manifestations, and increasing frequency and severity of exacerbations. Expiratory flow limitation is pathophysiological hallmark of COPD⁴.

In most cases, lung cancer is strongly associated with direct consumption of tobacco products. The second most common known cause of lung cancer is radon, which is associated with a significant increase in lung cancer risk and with other risk factors including asbestos exposure⁵.

The problem is whether the length of the period of cigarette smoking has a more reflection to the COPD and lung cancer or the bigger number of cigarettes smoked daily?

Aim of the study: Are there any statistically significant differences in the frequency of illnesses of COPD and lung cancer between the groups of smokers? (The group of smokers according to the number of years they have been smoking and the group of smokers according to the average number of cigarettes daily smoked)

Does the length of smoking have a greater impact on frequency of illness from COPD and lung cancer than the number of cigarettes smoked daily?

Materials and Methods

Data were obtained from a sample of 420 subjects, smokers and non-smokers, both genders, age 25-64 years old. The sample was divided into two groups of smokers; the first group consisted of 240 examinees with different period of length of smoking cigarettes and the second group consisted of 180 examinees that

smoked a different number of cigarettes per day.

In the group of smokers according to the length of smoking period there were much more male smokers in older subgroups vs. much more female smokers in younger subgroups. There was statistically significant difference between the genders of examinees (Table 1).

In the group of smokers according to the average number of cigarettes smoked daily, there were much more "heavy smokers" in male subgroups than in female subgroups. There was statistically significant difference between the genders of examinees (Table 2).

The investigation was prospective, randomized, clinically and controlled study, from Tuzla region. Each examinee was treated per anamnesis and physical examination. Also, each examinee was subject to lung function tests (FEV₁ and FEV₁/FVC).

Inclusion criteria for the study:

- Age from 25 to 65 years, both gender,
- Smokers according to the length of smoking, from 0.1 to > 30.1 years,
- Smokers according to the number of cigarettes smoked daily.

Exclusion criteria for the study:

- Other age groups (<25 and >65 years),
- Heart diseases dating from childhood (congenital heart defect),
- Diseases which can leave repercussion on heart (endocarditis),

- Neurological diseases (epilepsy, sclerosis multiplex, Parkinson's disease, amyotrophic lateral sclerosis),

Statistical Analysis: The data were expressed as mean \pm SD. The statistical significance was evaluated by hi-square test and Student's t test.

Results

There was statistically significant difference between the genders of examinees (Table 3).

Average value of smoking consumption period was higher in the group of examinees according to the length of smoking consumption period than in the group of examinees according to a number of cigarettes smoked daily. Certified with student t-test there was statistically significant difference between the groups (Table 4).

Lung diseases were presented in two thirds of examinees in the group of smokers according to a number of cigarettes smoked and in a half of examinees in the group of smokers according to the length of smoking consumption period. The most frequent lung disease in both groups of examinees was COPD. Chi square test confirmed a statically significant difference between the examined groups in the frequency of lung diseases (Table 5).

On the table 6 we see that very high number of smokers in both groups of examinees have breathing difficulties (such as breathe hard under exercise and breathe hard at peace). We also see, that the doubly more examinees in the group of smokers according to the length of smoking consumption period breathe hard at peace. Certified with Chi-square test we found a statistical significant difference between examined groups.

It is evident that the symptom of wheezing in chest has about two thirds of examinees in both groups, even more of examinees in the group of smokers according to the length of smoking consumption period, but certified with Chi square test we did not find a statistical signification between two examined groups.

The symptom of cough is represented in two thirds of smokers in the group of examinees according to the length of smoking consumption period than in the group of examinees according to a number of cigarettes smoked. There is statistically proven significance of differences in existing of cough between examined groups.

Productive cough permanently or longer than 3 months during one year was frequently registered in a group of smokers according to a number of cigarettes smoked (more than in two thirds of smokers). There was not any statistical signification between examined groups.

The middle value of FEV₁ in the group of smokers according to a number of cigarettes smoked is considerable lower in relationship to the middle value in the group of smokers according to the length of smoking consumption period, although the middle values of both groups of examinees are in the range of predicted values. It is evident that there exists a significant statistical significance between these two examined groups.

The middle values of ratio FEV₁/FVC are different between examined groups. The middle value of ratio FEV₁/FVC in the group of smokers according to a number of cigarettes smoked are lower compared with the middle value of ratio of FEV₁/FVC in the group of smokers according to the length of smoking consumption period, thus, in this case, we notice that the middle values of this

parameter in both groups of examinees are still in the range of predicted values. If we certified the examined groups with t-test, it is evident of existing of statistically significant differences between examined groups (presented on the table 11)

Discussion

The "1001 Dalmatins" research program obtained a random sample of 1001 adult inhabitants of Adriatic island villages in Croatia. The total sample consisted of 454 men and 547 women. Subjects were divided according to age and smoking habits. Age and smoking prevalence (22.7% vs. 22.1%) were not significantly different between gender, but significant differences in smoking habits were recorded: smoking intensity (cigarettes/d) 21.8 ± 12.8 in men and 16.9 ± 10.8 in women; smoking duration (y) 25.0 ± 13.9 in men and 21.3 ± 8.9 in women. Men smoked longer and intensively and had higher pack years count. Respiratory symptoms occurred much more in smokers than in non-smokers: chronic dyspnea in men (18.4%), and (14.0%) in women, while acute and/or chronic cough occurred often in women (22.3%) than in men (19.4%). Smoking was the strongest risk factor for acute and chronic dyspnea and airway narrowing⁶.

In this study were enrolled 420 subjects from Tuzla region. A sample was consisted of both genders, smokers and non-smokers, who were divided in two groups of examinees according to the length of smoking consumption period and according to a number of cigarettes smoked per day. In both groups we found much more men (65.7% vs. 62%) than women (34.3% vs. 38%), who smoked, and there was significant differences between gender. Significant difference was recorded in smoking habits of subjects. Smoking duration in the group of smokers according to the

length of smoking consumption period was 20.34 ± 10.63 y and in the group of smokers according to a number of cigarettes smoked daily 13.55 ± 8.20 y. Much more men than women smoked a big number of cigarettes, especially, in the subgroups 41-50c/d and >51c/d, where we registered 52 men and only 8 women. Quality of breathing, in the meaning breathe hard under exercise (64.58% vs. 66.11%), breathe hard at peace (20.02% vs. 9.4%), and permanently or occasionally cough longer than 3 months in one year period (77.5% vs. 61.66%) occurred much more in the group of smokers according to the length of smoking consumption period than in the group of smokers according to a number of cigarettes smoked per day. There were statistically proven significance of differences in existing of respiratory symptoms between examined groups.

A total of 370 COPD patients were enrolled from February 2002 to June 2004 in a study in Denmark. Average age was 61.0 years and mean FEV₁ was 55.8% of predicted. At baseline, the study population smoked a mean of 19.6 cigarettes per day (mean, 42.7 pack-years). Fewer than one tenth of those enrolled smoked < 7 cigarettes per day (7.6%) or > 30 cigarettes per day (8.1%)⁷. A prospective study of factory workers in Shanghai followed over 16 years indicated an adjusted relative risk of COPD mortality of 2.5 for male smokers compared to never smokers, and a strong positive dose-response relationship was shown. With regard to respiratory function, it must be pointed out that smokers are at higher risk of decreased FEV₁ with an excess of annual FEV₁ decline ranging from 7ml/year to 33ml/year⁸.

We found that the middle values of FEV₁ (82.77% vs. 97.64%), and FEV₁/FVC (86.02% vs. 97.73%) in the group of smokers according to a number of cigarettes smoked were lower in relationship to the middle values in the group of smokers according to

the length of smoking consumption period, although the middle values of both groups of examinees were in the range of predicted values. We suppose, we got those middle values because nonsmokers were included as subgroup in both groups of examinees.

Fletcher and colleagues⁹ studied a group of working men in London over 8 years and found that the average rate of decline of FEV₁ was 0.03L/yr, and that decline was twice as fast in smokers. Fletcher and colleagues also found that chronic cough and sputum (chronic bronchitis, chronic mucus hypersecretion) predicted the number of acute exacerbations of cough and sputum thought to represent airways infection, but did not predict rate of decline of FEV₁. These findings essentially refuted the "British hypothesis" concerning the pathogenesis of COPD, which was that COPD resulted from repetitive airways infections. This conclusion, in turn, tended to incriminate tobacco smoke as the direct cause of the lung damage of COPD. The third survey of the Obstructive Lung Disease in Northern Sweden studies cohort was performed in 1996, and 5189 subjects (88%) responded to the postal questionnaire. Of the responders, a random sample (1,500 subjects) was invited to an examination in 1996 and in 2003. The 7-years cumulative incidence of COPD was 11.0% and 4.9% respectively, according to GOLD and GOLD II, and was significantly related to smoking (smokers, 18.8% and 10.6% respectively, ex-smokers, 10.5% and 5.2% respectively; nonsmokers, 7.6% and 1.6% respectively)¹⁰. At the moment the study was taken out the most frequent lung disease in both groups of examinees was COPD, in the group of smokers according to a number of cigarettes smoked per day 52.2% and in the group according to the length of smoking consumption period 39.16%.

In 2001 29% of men and 20% of women smoked daily in Finland. Lung cancer incidence rates (from 1980 to 2000) were

available at the Finnish Cancer Registry. The analysis indicated that the increase in lung cancer incidence was significantly associated with the smoking prevalence 20 years previously ($p < 0.001$), and the correlation was high ($r^2 = 0.642$)¹¹. In the UK accounts for 25% of male and 18% of female cancer deaths¹². Public Health Institute¹³ of Tuzla canton has been making the hospital registration of the ill with the malign neoplasm since 1988, interrupted in the period from 1992 until 1995. The supposition that, an increase of the malign neoplasm in the Tuzla canton happened in after the war period has been investigated from 1996 on, through the hospital registration of the ill. The incidence of lung cancer in 2001 was 42.56/100000.

Beside the COPD, lung cancer was found in both groups of examinees. In the group according to a number of cigarettes smoked per day (5.5%) and in the group according to the length of smoking consumption period (4.1%). It is distinctly and confirmed the fact that smoking prevalence, smoking intensity (cigarettes/d) and smoking duration are the key points for existing of lung diseases, especially COPD and lung cancer.

Conclusions

Highly statistically significant difference was estimated in examinees by gender related to the length of smoking consumption period and the average number of cigarettes daily smoked, in men (65.7% vs. 62%) and in women (34.3 vs. 38%), as well as in average values of smoking consumption period, which was also higher in the group of examinees according to the length of smoking consumption period than in the group of examinees according to a number of cigarettes smoked daily (20.34y vs. 13.55y).

Chi square test confirmed a statically significant difference between the examined groups in the frequency of lung diseases ($p < 0.05$). Respiratory symptoms as breathing difficulties (such as breathe hard under exercise and breathe hard at peace), and a cough, which lasted longer than 3 months in one year, occurred much more in the group of smokers according to the length of smoking consumption period. Certified with Chi-square test we found a statistical significant difference between examined groups ($p < 0.05$).

The middle values of FEV₁ and FEV₁/FVC in the group of smokers according to a number of cigarettes smoked were lower in relationship to the middle values of FEV₁ and FEV₁/FVC in the group of smokers according to the length of smoking consumption period. Certified with t-test we found a significant statistical significance between examined groups.

We confirmed the hypothesis that the length of smoking consumption period has more impact on existing of respiratory symptoms, lung impairment, as well as lung diseases.

This conclusion, tended to incriminate tobacco smoke as the direct cause of the lung damage of COPD.

Conflict of interest: None to declare

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Table 1: The group by length of smoking consumption period. Structure of subgroups by gender and length of smoking consumption period

	Nonsmokers	0-5	5.1-10	10.1-15	15.1-20	20.1-25	25.1-30	>30.1	Total
Male	6	24	18	13	12	19	27	25	144
Female	24	6	12	17	18	11	3	5	96
Total	30	30	30	30	30	30	30	30	240
X² test ($\alpha = 0.05$)		51.667	p<0.05		S				

Table 2: The group according to the average number of cigarettes smoked daily. Structure of subgroups by gender and average number of cigarettes smoked daily

	Nonsmokers	10-20/24h	21-30/24h	31-40/24h	41-50/24h	>51/24h	Total
Male	6	8	12	21	26	26	99
Female	24	22	18	9	4	4	81
Total	30	30	30	30	30	30	180
X² test ($\alpha = 0.05$)		54.343	p< 0.05		S		

Table 3: Structure of groups of examinees by gender related to length of smoking consumption period and the average number of cigarettes daily smoked

	Male	Female	Total
Non smokers	12 (20%)	48 (62%)	60 (100%)
Smokers according to the length smoking consumption period	138 (65,7%)	72 (34,3%)	210 (100%)

Smokers according to the number of cigarettes smoked	93 (62%)	57 (38%)	150 (100%)
X² test ($\alpha = 0.05$)	41.640	p<0.05	S

Table 4: Average values of smoking consumption period of examinees according to the length of smoking period and to a number of cigarettes smoked daily

	According to a number of cigarettes smoked daily	According to the length of smoking period
Average values	13.55	20.34
Std. Dev.	±8.206	±10.631
t-test	6.834	
p	0.0001	
Significance ($\alpha=0.05$)	S	

Table 5: Lung diseases in smokers according to the length of smoking consumption period and the number of cigarettes smoked

	Lung Cancer	COPD	Bronchiectasis	TBC sec. fibrosis	Without disease
Smokers according to the length smoking consumption period	10 (4.1%)	94 (39.16%)	2 (0.83%)	14 (5.83%)	120 (50%)
Smokers according to the number of cigarettes smoked	10 (5.5%)	94 (52.2%)	2 (1.11%)	12 (6.6%)	62 (34.4%)
X² test ($\alpha = 0.05$)	10.276	p<0.05	S		

Table 6: Quality of breathing

Breathing difficulties	smokers according l.c.p.	smokers according to n.c.s.	Total
1. (I have no difficulties of breathing)	37 (15.41%)	44 (24.44%)	121 (44.02%)
2. (I breathe hard under exercise)	155 (64.58%)	119 (66.11%)	264 (126.52%)
3. (I breathe hard at peace)	48 (20.02%)	17 (9.44%)	35 (29.46%)
X² test ($\alpha = 0.05$)	11.789	p<0.05	S

*l.c.p. the length of consumption period

*n.c.s. the number of cigarettes smoked

Table 7: Wheezing

Wheezing	smokers according to l.c.p.	smokers according to n.c.s.	Total
1 (yes)	39 (16.95%)	34 (18.88%)	73 (35.83%)
2 (no)	58 (24.16%)	45 (25%)	103 (49.16%)
3 (from time to time)	143 (59.58%)	101 (56.11%)	244(11569%)
X² test (α = 0.05) 0.65 p>0.05 NS			

*l.c.p. the length of consumption period

*n.c.s. the number of cigarettes smoked

Table 8: Do you have a cough permanently or occasionally longer than 3 months in one year period?

Cough	smokers according l.c.p.	smokers according n.c.s.	Total
1 (yes)	186 (77.5%)	111 (61.66%)	287(134.99%)
2 (no)	54 (22.5%)	69 (38.33%)	103 (65.01%)
X² test (α = 0.05) 11.699 p<0.05 S			

*l.c.p. the length of consumption period

*n.c.s. the number of cigarettes smoked

Table 9: Do you have productive cough /sputum production/permanently or occasionally longer than 3 months in one year period?

Productive cough	smokers according l.c.p.	smokers according n.c.s.	Total
1 (yes)	169 (70.41%)	141 (78.33%)	310 (148.74%)
2 (no)	71 (29.58%)	39 (21.67%)	110 (51.26%)
X² test (α = 0.05) 2.938 p<0.05 NS			

*l.c.p. the length of consumption period

*n.c.s. the number of cigarettes smoked

Table 10: The review of middle values of FEV₁ in smokers according to the length of smoking consumption period and a number of cigarettes smoked

FEV ₁	smokers according n.c.s.	smokers according l.c.p.
Middle values	0,8277	0,9764
Std. Dev.	±0,24319	±0,24778
t-test		7,569
p		0,034
Signif. (α=0.05)		S

*l.c.p. the length of consumption period

*n.c.s. the number of cigarettes smoked