Is obesity a preventive factor for lung cancer?

H. KOLLAROVA[*], L. MACHOVA, D. HORAKOVA, L. CIZEK, G. JANOUTOVA, V. JANOUT

Department of Preventive Medicine, School of Medicine, Palacky University, Hnevotinska 3, 775 15 Olomouc, Czech Republic, e-mail: kollarh@tunw.upol.cz

Lung cancer is a disease with multifactorial etiology, smoking playing the most important role among its risk factors. Some studies, however, indicate an inverse association between increased body-mass index (BMI) and the risk of lung cancer. In this paper, the association between BMI and lung cancer risk is analysed in two independent studies. In the first study, 751 lung cancer patients were compared to 30 058 controls. In the second study, 91 lung cancer pacients were matched to 91 healthy controls. An inversed association was found between increased BMI and lung cancer risk. The inverse association remained significant after adjustment for age, sex, and smoking.

Key words: lung cancer, BMI, inverse association

Lung cancer is one of the most serious tumor diseases, with high incidence and mortality rates. In the year 2002, world incidence was 1 352 132, mortality in the same year was 1 178 918 persons [1].

In the Czech Republic, the trend of lung cancer occurrence is still increasing, despite the fact that incidence and mortality rates in men are decreasing since the year 1990. In women, however, lung cancer has become a tumor with the most rapidly increasing incidence over the past years.

In the year 2003, the total lung cancer incidence was 5 995 persons in the Czech Republic; 4 596 cases were diagnosed in men and 1 399 cases in women. In the same year, 5 215 persons died, 4 008 of which were men and 1 207 women [2].

Lung cancer is a multifactorial disease. The most important risk factor is smoking, which is responsible for 83 – 94% of lung cancer cases in men and 57 – 80% of lung cancer cases in women. There are, however, other occupational, life-style, and environmental factors that play a role in lung cancer risk modification, especially nutrition and alcohol consumption [3, 4].

Some epidemiologic studies indicate also an association between body-mass index (BMI) and lung cancer risk. In the majority of those studies, increased risk of lung cancer was observed in persons with lower BMI [5]. The aim of this study, therefore, was to clarify the role of BMI in modifying lung cancer risk.

_____
[*] Corresponding author

Materials and methods

Two sources of data were used to analyze the relation between BMI and lung cancer. The first source was a database which included 49 426 persons from the District Sumperk who had undergone preventive oncologic check-ups between 1975 – 1978. In 2002, the database was merged with data from the National Cancer Registry (Database 1). Nine hundred ninety-eight cases of lung cancer were diagnosed in this population; 751 cases (667 men and 84 women) for which information on BMI was available were included in analysis. The control group included 30 058 persons from the database who suffered from neither tumor nor cardiovascular and metabolic disease. Persons with BMI higher or equal 30 (the obese) were compared to persons with BMI higher or equal 25 and lower than 30 (the overweight) and to persons with normal weight (BMI higher or equal 18.5 and lower than 25).

The second source was created within the frame of a multicentric IARC study focused on the relationship between lung cancer and life-style, environmental, and occupational factors, which was conducted between October 1999 and January 2002 (Database 2). In the course of the study, 91 lung cancer patients (70 men and 21 women) were matched with 91 cancer free controls. Hospital-based case-control study was the selected design for analysing the relationship between BMI and lung cancer risk.

The study was conducted in University Hospital, Olomouc. Information on exposure was obtained directly from the par-

Table 1. BMI distribution.

| BMI | Database 1 | | | | Database 2 | | | |
| | Men | | Women | | Men | | Women | |
	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls
≥30	64	2 135	12	4 008	18	23	2	7
≥25 <30	299	6 945	34	6 933	26	31	7	9
≥18,5 <25	304	4 280	38	5 757	26	16	12	5

Table 2. Comparison of the lung cancer risk in the obese (BMI ≥ 30) vs. the overweight and normal weight, respectively (crude odds ratio).

| | BMI | Database 1 | | Database 2 | |
		OR	95% CI	OR	95% CI
Total	≥25 <30	0,52	0,40-0,67	0,81	0,36-1,79
	≥18,5 <25	0,36	0,28-0,47	0,37	0,16-0,86
Men	≥25 <30	0,70	0,52-0,92	0,93	0,38-2,26
	≥18,5 <25	0,42	0,32-0,56	0,48	0,18-1,26
Women	≥25 <30	0,61	0,30-1,22	0,37	0,04-3,07
	≥18,5 <25	0,45	0,22-0,90	0,12	0,01-1,02

Table 3. Comparison of the lung cancer risk in the obese (BMI ≥30) vs. the overweight and normal weight, respectively (odds ratio adjusted for age, sex, and smoking).

| BMI | Database 1 | | Database 2 | |
	OR	95% CI	OR	95% CI
≥18,5 <25	1	–	1	–
≥25 <30	0,71	0,60-0,83	0,41	0,19-0,90
≥30	0,48	0,37-0,62	0,31	0,31-0,72

ticipants; standard interviews and identical questionaires were used for all persons. Among other data, information on body weight and body height was collected. Numbers of persons in each group are presented in Table 1.

BMI higher or equal 18.5 and lower than 25 was considered normal weight, BMI higher or equal 25 and lower than 30 was considered overweight, and BMI higher or equal 30 was considered obesity. In both populations, lung cancer risk in persons with normal weight was compared to lung cancer risk in the obese and in the overweight, respectively. Crude odds ratio and odds ratio adjusting for age, sex, and smoking were computed.

When collecting data on exposure, information on body weight two years prior the tumor diagnosis was required. Incipient disease as an explanation for weight loss was thus avoided.

Statistical analysis was carried out using the Statistica and EPI-Info programmes.

Results

In the first population, when comparing the obese (BMI≥30) to the overweight, total crude OR was 0.52, 0.70 in men and 0.61 in women (Table 2). When comparing the obese with persons with normal weight, crude OR was 0.36, 042 in men and 0.45 in women (Table 2).

In the second population, when comparing lung cancer risk in the obese to the overweight, crude OR was 0.81, 0.93 in men and 0.37 in women (Table 2). When comparing the obese with persons with normal weight, crude OR was 0.37, 0.48 in men and 0.12 in women (Table 2).

After adjustment for age, sex, and smoking, decreasing OR was observed with increasing BMI. When compared to those with normal weight, the overweight had OR = 0.71 in the first population and 0.41 in the second population. For the obese, respective values were OR = 0.48 in the first population and OR = 0.31 in the second population (Table 3).

In the first population, all crude OR values were statistically significant with the exception of overweight women, which was statistically insignificant probably due to small number of subjects. All adjusted OR values were statistically significant. In the second population, crude OR values indicated lower lung cancer risk in the obese, though they were not statistically significant. Adjusted OR values, however, did reach statistical significance.

Discussion

In spite of smoking remaining the most important risk factor for lung cancer, some epidemiologic studies have observed lower BMI in patients with lung cancer over the past decades. A question arises [6, 7] whether lean persons are at higher risk of developing lung cancer, or whether some confounding factors are responsible for the increased risk [8]. Among potential confounders, smoking is on the first place [9], followed by occupational hazards (asbestos, chromium, silica compounds), enviromental factors (radon, formaldehyde), lifestyle factors (nutrition), and genetic and hormonal factors.

Increased BMI is known to increase the risk of a number of tumor diseases. An inverse association, however, is rare, although some recent sudies including the presented study indicate the possibility of such association.

In Czech women, statistically significant association was found between lower BMI and lung cancer [7]; for BMI 29,0 and higher, crude OR was 0.5 (95% CI 0.2 – 1.0) and adjusted OR was 0.92 (95% 0.87 – 0.98). In a large hospital case – control study carried out in the U.S.A., an increased

risk of lung cancer was described in asociation with decreasing BMI [6]. Similar results were observed in a Finish prospective study in which more than 25 000 men aged 20 – 75 years were enrolled [10]. In a study including 363 cancer patients and 1 089 controls, the Japanese authors found an inverse association in men but not in women [5]. Similar results were observed in the U.S.A. by Drinkard et al. [8]; the authors attributed their findings to the confounding effects of smoking. In our study, similar to some other studies, the inverse association was observed even after adjustment for smoking.

The results found in medical literature are not consistent. In a case – control study carried out in the U.S.A., which enrolled 188 couples of non-smokers and 224 couples of ex-smokers, the inverse association was not confirmed; on the contrary, persons with BMI › 30.84 had the risk of lung cancer doubled when compared to persons with BMI ≤ 21.26 [11]. However, the results of the presented study are in agreement with a majority of published studies, and the existence of an inverse association is supported especially by the first part of the study in which a large database of cases and controls was analysed.

Conclusion

The results of this paper are in agreement with the findings of a number of studies, which describe an inverse association between BMI levels and the risk of lung cancer. The inverse association remains significant after adjustment for age, sex and smoking.

References

[1] CANCER*Mondial*. Globocan 2002. Cancer incidence, mortality and prevalence worldwide. Available from: URL:http://www.dep.iarc.fr/.

[2] DUŠEK L, MUŽÍK J, KUBÁSEK M, et al.: The Czech national web portal of cancer epidemiology [online]. Masaryk University, [2005], 26.3.2007 [2007-3-26]. Incidence and mortality C34 – malignant neoplasm of lung in 2003. Available from: URL:http://www.svod.cz.

[3] MAREL M, MELÍNOVÁ L, ŠŤASTNÝ B et al.: Time trends of epidemiologic parametres of lung cancer in the Czech Republic in 1970 – 1990. (Czech) Cas Lek Ces 1996; 135: 487–492.

[4] KOLLÁROVÁ H, JANOUT V, ČÍŽEK L. Life-style risk factors and lung cancer. (Czech) Hygiena 2003; 48: 79–87.

[5] KANASHIKI M, SAIRENCHI T, SAITO Y, et al.: Body-mass index and lung cancer: a case-control study of subjects participating in a mass-screening program. Chest 2005;128: 1490–1496.

[6] KABAT GC, WYNDER EL.: Body-mass index and lung cancer risk. Am J Epidemiol 1992; 135: 769–774.

[7] KUBIK A, ZATLOUKAL P, BOYLE P et al.: A case-control study of lung cancer among Czech women. Lung Cancer 2001; 31: 111–122.

[8] DRINKARD CR, SELLERS TA, POTTER JD et al.: Association of body mass index and body fat distributio with risk of lung cancer in older women. Am J Epidemiol 1995; 142: 600–607.

[9] KOZÁK JT. Oncological risk: smoking. Klinická onkologie 2000; special number: 5–7.

[10] KNEKT P, HELIOVAARA M, RISSANEN A et al.: Leanness and lung cancer risk. Int J cancer 1991; 49: 208–213.

[11] RAUSCHER GH, MAYNE ST, JANERICH DT: Relation between body-mass index and lung cancer risk in men and women never and former smokers. Am J Epidemiol 2000; 152: 506–513.