

PEPTIC ULCER AMONG POLISH RURAL POPULATION AND THE NICOTINIC INDEX

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Abstract: The paper presents the results of observations concerning the effect of cigarette smoking on the prevalence of peptic ulcer among 6,512 rural inhabitants aged 20-64, selected by two-stage sampling. Of these, 2,506 (38.6%) were regular smokers. In order to determine precisely the negative effect of smoking on the human body the nicotinic index was used (N.I.), calculated by multiplying the number of cigarettes smoked daily by the period of smoking (years). The three-stage scale of the nicotinic index was applied: I° - N.I. < 100, II° - N.I. = 100-300, III° - N.I. > 300. The mean value of the nicotinic index calculated for the total number of smokers in the study was 290.3. A statistically significant higher N.I. was observed in patients with peptic ulcer - 432.5, compared to patients with other diseases - 337.2, and healthy individuals - 203.3. Among patients with peptic ulcer the highest percentage of people with N.I. > 300 was noted (59.0%), compared to patients with other diseases (42.9%) and those who were healthy (22.6%). The differences observed between patients with peptic ulcer and those of the remaining groups were highly statistically significant ($p < 0.001$). The percentage of people with the lowest value of the nicotinic index (N.I. < 100) in individual groups was: in patients with peptic ulcer - 13.5% (the lowest), among patients with other diseases - 25.0%, in the group of healthy individuals - 38.5% (the highest). An increase was noted in the incidence of peptic ulcer with the value of the nicotinic index. Peptic ulcer occurred in 3.8% of patients with N.I. < 100, in 6.4% of those with N.I. = 100-300, and in 13.2% of patients with N.I. > 300. An increase in the percentage of patients with the nicotinic index was observed irrespective of the site of ulcer. It became most evident among patients who underwent surgical treatment due to peptic ulcer, where the highest value of the nicotinic index (N.I. > 300) was noted in 79.5%, in patients with gastric and duodenal ulcer - 66.7% and those with gastric ulcer - 59.6%. A positive correlation was observed between peptic ulcer incidence rates, complications of the disease and the value of the nicotinic index. The relationship between state of health and the value of the nicotinic index was confirmed. The results of the study showed that the nicotinic index was useful for determining the negative effect of cigarette smoking on the human body.

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INTRODUCTION

Tobacco, a native plant of America, was brought to Europe at the time of Christopher Columbus' expeditions. Initially, it was believed that this plant had therapeutic

properties. Jean Nicot, a French ambassador to Portugal who contributed to the spread of tobacco cultivation, used tobacco leaves as a medical agent against migraine. The term nicotine was derived from his surname and denotes the habit of tobacco smoking which in the second

half of the 20th century was considered as one of the greatest 'killers' of mankind. It has been discovered that tobacco smoking contributes to the occurrence of diseases of the respiratory and cardiovascular systems, alimentary tract, and also causes cancer.

Based on the literature concerning etiopathogenesis of the peptic ulcer, tobacco smoking is one of the factors predisposing to this disease [5, 11, 14, 17, 18, 26]. Everyday medical practice provides substantial evidence confirming this hypothesis, e.g. longer healing time of ulcers among smokers, more frequent relapses of the disease and a greater number of complications. In addition, epidemiological observations suggest that there exists a relationship between cigarette smoking and the occurrence of peptic ulcer [1, 11, 13, 21, 22, 23, 27], although some reports also cast doubt on this theory [28].

It was observed that peptic ulcer patients who were smokers were twice as prone to relapses of the disease, and that sickness absenteeism was three times higher [5]. The results of treatment with the antagonists of H₂ histamine receptor were similar to those obtained among non-smokers who were administered a placebo. A greater number of peptic ulcer complications was observed among smokers [4, 26]. In addition, higher mortality rates due to peptic ulcer were noted among smokers [4, 18].

The role of tobacco smoking in the pathogenesis of peptic ulcer has not been fully recognized. A considerable prevalence of this habit in Poland, as well as the lack of observations with the use of the nicotinic index, were the essential premises for conducting studies of this problem among rural population.

MATERIALS AND METHODS

The study was based on the results of the all-Polish comprehensive survey of the state of health of adult rural inhabitants conducted in 1990 by researchers from the Institute of Agricultural Medicine in Lublin, with the consideration of somatic, mental and social aspects of health [6, 25].

The analysis covered a representative group of rural population selected by the method of two-stage sampling. Records from all rural health centres in Poland (3,286), which are kept and annually updated by the Institute of Agricultural Medicine in Lublin, containing 34 parameters, were used for first-stage sampling. At the first stage of the study all health centres were divided into 150 groups according to their location, type of centre, distance to Health Unit (hospital), number of population in the region, percentage of farming population and deviation from the recommended model of employment. In each group two prevention-treatment regions were selected by means of stratified sampling and a sample of a required number of 300 first-stage units was obtained. The second-stage samples were selected based on communes where the selected health centres were located, and covered the population aged 18-64. According to the region and

sampling probability the size of the sample ranged from 10 - 120 people from one health centre. A total number of 8,091 rural inhabitants were selected for the study, and 7,006 respondents, i.e. 86.6% were classified for the study (the remaining people did not report for examinations). The two youngest age groups (18-19) were considered as not sufficiently representative for further analysis. These deviations most probably resulted from the inadequacy of the 1988 electoral rolls (people who reached the age of 18 were not always enrolled on the lists). 6,846 people were classified for statistical calculations, including 6,512 rural inhabitants aged 20-64 with a correctly completed Medical Examinations Chart. The latter sample was analysed in the present paper.

The study was conducted by trained rural health centre physicians and covered: a specially designed questionnaire, a detailed physical examination, and necessary laboratory tests. The results obtained were registered in a questionnaire, which also contained questions concerning detailed demographic and social data, hazardous agents present at the workplace, as well as data pertaining to housing conditions, mode of nutrition and habits. In order to determine the relationship between cigarette smoking and the occurrence of peptic ulcer the following parameters were analysed: prevalence of smoking, age at starting smoking, number of cigarettes smoked a day, and the period of smoking. Nicotinic index (N.I.) was analysed to determine the relationship between smoking and the occurrence of peptic ulcer. This index was calculated by multiplying the number of cigarettes smoked daily by the smoking period (years). The nicotinic index which covered two parameters - the number of cigarettes smoked a day and the period of smoking, should allow us to determine precisely the unfavourable effect of smoking on the human body. A three-degree scale of the nicotinic index was applied: I° - N.I. < 100, II° - N.I. from 100 to 300, III° - N.I. > 300.

Chi² test was used for analysis. Percentages were compared by means of a test of significance of differences between fractions. The level of $p < 0.05$ was adopted as significant.

RESULTS

At the time of study, the Polish rural population constituted 38.6% of the total number of Polish population, i.e. 14,623,000 people [21]. Among the total number of 6,512 rural inhabitants examined - 3,107 males and 3,405 females - 2,506 people (38.6%) were regular smokers, including 1,808 males (58.3%) and 690 females (20.6%); 678 (10.4%) - were ex-smokers, including 473 males (15.2%) and 205 females (6.0%); 3,314 (51.0%) were non-smokers, including 821 males (26.5%) and 2,493 females (73.4%).

The mean value of the nicotinic index calculated for the total number of respondents was 290.3: for patients with peptic ulcer - 432.5, for patients with other diseases -

Table 1. Compilation of patients with peptic ulcer, those with other diseases, and healthy individuals according to the nicotinic index.

Nicotinic index	Patients with peptic ulcer (A)		Patients with other diseases (B)		Healthy individuals (C)		Chi ² test value (DF = 1)	
	n	%	n	%	n	%	A - B	A - C
< 100	33	13.5	387	25.0	475	38.5	15.4***	56.3***
100–300	67	27.5	497	32.1	480	38.9	2.1	11.9***
> 300	144	59.0	665	42.9	279	22.6	22.0***	130.4***
Total	244	100	1,549	100	1,234	100		

*** p < 0.001

Table 2. Prevalence of peptic ulcer among smokers according to the value of the nicotinic index.

Groups in the study	Nicotinic index					
	< 100		100–300		> 300	
	n	%	n	%	n	%
Gastric ulcer	8	0.9	13	1.2	31	2.8
Duodenal ulcer	22	2.6	45	4.3	74	6.8
Gastric and duodenal ulcer	0	0	4	0.4	8	0.7
Patients who underwent surgical treatment due to peptic ulcer	3	0.3	5	0.5	31	2.8
Total	33	3.8	67	6.4	144	13.2
General number of respondents	895	100	1,044	100	1,088	100

Table 3. Site of ulcer among smokers by the value of the nicotinic index.

Nicotinic index	Site of ulcer								Chi ² test value (DF=1)		
	Gastric ulcer (A)		Duodenal ulcer (B)		Gastric and duodenal ulcer (C)		Patients who underwent surgical treatment due to peptic ulcer (D)		A - B	A - C	A - D
	n	%	n	%	n	%	n	%			
< 100	8	15.4	22	15.6	0	0	3	7.7	0.02	-	0.52
100–300	13	25.0	45	31.9	4	33.3	5	12.8	0.09	0.05	2.08
> 300	31	59.6	74	52.5	8	66.7	31	79.5	0.78	0.02	4.05*
Total	52	100	141	100	12	100	39	100			

* p < 0.05

337.2, and for healthy individuals - 203.3. The differences between the mean N.I. in patients with peptic ulcer and those with other diseases, as well as healthy individuals, were statistically significant ($p < 0.001$). The nicotinic index below 100 was noted among 29.6% of regular smokers in the study, N.I. = 100 to 300 - in 34%, and N.I. >300 - in 35.9%.

Table 1 presents the compilation of patients with peptic ulcer, respondents with other diseases, and those who were healthy according to the nicotinic index. In individual groups, the percentage of people for whom the nicotinic index reached the highest value (N.I. > 300) was as follows: among patients with peptic ulcer - 59.0% (the

highest); among patients with other diseases - 42.9%, whereas among healthy individuals - 22.6% (the lowest). The differences between patients with peptic ulcer and the remaining groups in the study were statistically significant ($p < 0.001$). The percentage of respondents for whom the value of the nicotinic index was the lowest (N.I. < 100) was as follows in individual groups: among patients with peptic ulcer - 13.5% (the lowest); among those with other diseases - 25.0%, and in healthy individuals - 38.5% (the highest). The differences observed between patients with peptic ulcer and the remaining groups were highly statistically significant ($p < 0.001$). It was observed that the percentage of patients with peptic ulcer considerably

increased with the value of the nicotinic index. In this group, the percentage of patients with the highest value of the nicotinic index was significantly greater, compared to that noted for respondents with the lowest N.I. value.

Table 2 presents the prevalence of peptic ulcer among smokers according to the value of the nicotinic index. It was noted that the incidence of peptic ulcer increased with the value of the nicotinic index. Peptic ulcer occurred in 3.8% of respondents with N.I. < 100; among 6.4% of those with N.I. = 100 to 300, and in 13.2% of people with N.I. > 300.

Table 3 presents the compilation of sites of ulcer among smokers by the value of the nicotinic index. Considering each site of the ulcer, the percentage of patients increased with the nicotinic index. This was most clearly observed among patients who underwent surgical procedures due to peptic ulcer, where the highest value of the nicotinic index (N.I. > 300) was noted in 79.5% of respondents; while among patients with gastric and duodenal ulcer this percentage was 66.7%; and in those with gastric ulcer - 59.6%. The difference between patients who underwent surgical procedures due to peptic ulcer and those with gastric ulcer was statistically significant at $p < 0.05$.

DISCUSSION

Among the total number of 6,512 rural inhabitants in the study 38.6% were regular smokers (58.3% of males and 20.6% of females), 10.4% - were ex-smokers and 51.0% were non-smokers. Based on the results of the study conducted in 1987 it was estimated that 30.3% of rural inhabitants aged over 16 were regular smokers - 48.9% of males and 11.7% of females [19]. The greater percentage of smokers noted among the population under study may be due to both the age of respondents (over 20) and an increased prevalence of the smoking habit observed in Poland at that time.

The application for the first time of the nicotinic index in order to evaluate the effect of smoking on the prevalence of peptic ulcer enabled us to prove statistically significant differences ($p < 0.001$) between the mean value of the nicotinic index among peptic ulcer patients (432.5), those who had other diseases (337.2) and healthy individuals (203.3).

A significantly higher percentage of respondents with the highest values of the nicotinic index ($p < 0.001$) was noted among patients with peptic ulcer, compared with patients who had other diseases and healthy rural inhabitants; while the percentage of respondents with the lowest values of the nicotinic index was significantly lower ($p < 0.001$).

Among people with the highest values of the nicotinic index (>300) the highest percentage of patients with peptic ulcer was observed (13.2%), while among people with the lowest N.I. values the number of peptic ulcer patients was 3.5 times lower. A considerably higher

morbidity rates due to peptic ulcer were observed among smokers by Anda *et al.* [1], Jędrychowski *et al.* [11], Kato *et al.* [13], Sablich *et al.* [21], Schabowski and Skrzydło-Radomańska [22].

Among patients who underwent surgical procedures due to peptic ulcer, the number of people with the highest nicotinic index was the greatest, compared to other sites of ulcer ($p < 0.05$). This confirmed the relationship between cigarette smoking and the occurrence of peptic ulcer complications which, in a large number of cases, lead to surgical treatment [4, 26].

Experimental studies, as well as the results of studies on humans, did not explicitly confirm the direct ulcer-inducing effect of nicotine. The widely - known effect of nicotine - a decrease in the production of bicarbonates by the pancreas - could be the only explanation for an increased probability of the occurrence of duodenal ulcer among smokers [14]. Reports concerning the unfavourable effect of smoking on gastric and pancreas secretion, as well as on the motor activity of the upper section of the alimentary tract, considerably expanded the knowledge of pathomechanisms associated with smoking [9, 14, 17, 26]. The last decade has brought to light many new data which confirm that smoking may possibly contribute to the pathogenesis of peptic ulcer. Ogle *et al.* [17] in their experiment conducted on rats observed an ulcer-inducing effect of nicotine. Cryer *et al.* [8] and Lindel *et al.* [16] showed a smaller level of prostaglandin in the mucous membrane of the stomach and duodenum in smokers, compared to non-smokers. Endoh and Leung [9] observed a decreased blood flow in the gastric mucosa due to nicotine. Jones *et al.* [12] indicated a decrease in the secretion of an epidermal growth factor (EGF) by the salivary glands in smokers with peptic ulcer, compared to non-smokers.

The discovery of *Helicobacter pylori* (Hp) bacterium in the gastric mucosa essentially changed attitudes concerning the pathogenesis of peptic ulcer. It was found that this bacterium is an etiologic factor in about 90% of cases of duodenal ulcer and about 70% of cases of gastric ulcer. An effective eradication of *Helicobacter pylori* bacteria results in the complete recovery in the majority of peptic ulcer cases. It became evident that Hp infection is very prevalent - it concerns over 50% of the world population, males and females equally; peptic ulcer, however, is observed only in about 10–15% of the population infected, and is considerably more frequently among males [23, 24]. The studies showed that apart from an unfavourable effect on the defence mechanism of the gastric mucosa [8, 9, 14, 15, 16] cigarette smoking increases the risk of *Helicobacter pylori* infection and may contribute to the pathogenic effect of this bacterium. Bateson [2] observed that *Helicobacter pylori* infection concerns 49.6% of smokers and only 35.5% of non-smokers and ex-smokers. Bateson [2, 3] and Tursi *et al.* [29] noted that smoking decreases the immunologic resistance of the mucous membrane and increases

Helicobacter pylori cytotoxic effect. Nicotinism is also associated with an increasing resistance to antibiotics [7] and poorer results of Hp eradication [10].

A more than three-fold increase in the incidence of peptic ulcer with the growing value of the nicotinic index, as well as a significantly higher percentage of people with high nicotinic index among peptic ulcer patients, compared to patients with other diseases and healthy individuals, confirm the role of smoking in the pathogenesis of peptic ulcer. The results of the study confirmed the usefulness of the nicotinic index for epidemiological assessment of the hazardous effect of cigarette smoking on the prevalence of peptic ulcer disease.

CONCLUSIONS

The studies conducted based on a representative group of 6,512 rural inhabitants aged 20-64 allowed us to draw the following conclusions:

1. A positive correlation was observed between peptic ulcer incidence rates and the value of the nicotinic index; among smokers with the highest index (>300) peptic ulcer was diagnosed in 13.2% of respondents, while in the group with the lowest N.I. value (<100) only in 3.8%.

2. Peptic ulcer complications leading to surgical procedure are associated with the growth in the nicotinic index.

3. Nicotinic index seems to be a good measure in the evaluation of the negative effect of cigarette smoking on the human body.

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