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*The effects of environmental factors
on the incidence of Helicobacter pylori infection
in the adult population of the Lublin region*

The infection of *Helicobacter pylori* (*H. p.*) is found to be one of the most significant pathogenic factors in the diseases of the upper alimentary tract. It is associated with about 95% of duodenal and 76% of gastric ulcers. It contributes to mucosa associated lymphoid tissue (MALT) lymphoma and gastric carcinoma. According to the International Association for Research on Cancer (IARC), *H. pylori* belongs to the class I carcinogens. It is also included on the list containing aflatoxin, cytostatics, hepatitis virus B, whose carcinogenic action is commonly recognized (7, 8).

Moreover, it was observed that the *H. p.* infection was related to NUD, although its role in this disease remains controversial. Numerous studies attempted to demonstrate that *H. p.* was associated with vascular diseases, particularly ischaemic heart disease, dermatosis, hepatic and biliary diseases, autoimmune disorders and many afflictions of unknown etiology.

The *H. p.* infection is a widespread phenomenon, its intensification in particular populations is clearly associated with socioeconomic status and age. In the countries characterized by low economic and sanitary conditions, the *H. p.* infection develops already in the first years of life and successively increases affecting about 100% of the 50-year-old population; in the developed countries the percentage of cases in children under 10 years of age is low and in adults does not exceed 40%. In Poland, the studies reveal 15% of infections in 2-year-old children and the percentage of the infected gradually increases with age reaching over 45% in adolescents up to 17 years of age and over 70% in adults (4, 9). Since the human being has been the only identified source of these bacteria, the most important way of transmission is by person-to-person contact.

The fact that *H. p.* was detected in the saliva, dental plaque and oral mucosa indicates that the bacterium may be spread by close physical contact (kiss, objects contaminated with saliva), especially among family members (10). The children whose parents are infected with *H. p.* are more susceptible to infection. However, some literature data suggest that in 30% of cases the infection may originate from the extra-family source.

There are three known ways of transmission of *H. p.* infection. The most common spread is by mouth-to-mouth contact, which predominates in the highly developed countries with proper sanitary habits. This is the major way of transmission in children and young people. In the countries of low socioeconomic status, developing countries and those with poor sanitation the faecal-oral spread is found to be the dominant one (dirty hands). The third possible way of infection is the gastric-oral spread by direct contact with vomits and gastric secretions. The preventive measures against *H. p.*

infections have not been worked out to date. In order to avoid the infection proper hygiene should be kept, particularly in the places for children and adolescents (kindergartens, schools).

The aim of the study is to analyse the epidemiological trends of the *H. p.* infection, the effects of environmental conditions, lifestyle, diet and sanitary habits on the infection incidence in the adult population of the Lublin region.

MATERIAL AND METHODS

In all, 585 adults (out of 1,600 randomly chosen individuals) who reported for the epidemiological examinations of the *H. p.* infection in the Lublin region were enrolled in the study. The research was conducted within the project ordered by the Ministry of Health and State Committee for Scientific Research in the years 2001–2002. The project was carried out simultaneously in 9 Polish centers. In the Lublin region, the examined population was divided into 3 groups according to the place of residence: municipal, provincial and sub-provincial centers. The randomly chosen participants were subjected to physical examinations, their history taken and personal questionnaires completed. The questionnaire data were sorted out and analysed using various statistical methods and professional computer programs. The material obtained was compiled in tables and graphs. Moreover, 2 ml of venous blood were collected from each person to determine the titre of antibodies against *H. pylori* in the IgG class. The antibody concentration > 24 U/ml was considered positive.

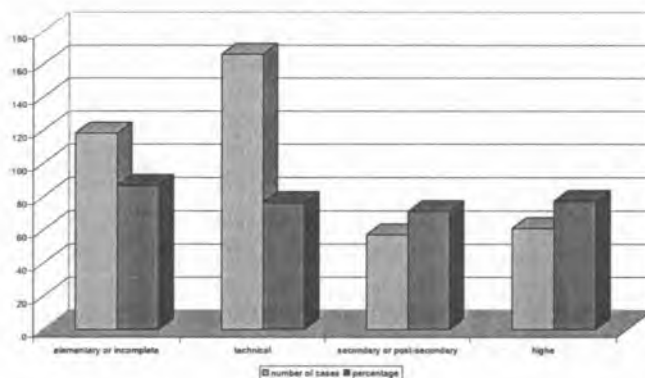
RESULTS

From the group of 1,600 randomly chosen adults, 585 persons reported for examinations (36.5%). The most numerous population lived in the rural centre (45.8%), the lowest number was available in the provincial center (25.5%). The serum level of antibodies against *H. p.* in the IgG class was determined in 512 patients (the remaining participants did not give their consent for blood tests). The positive results (> 24 IU/ml) were found in 402 individuals (78.52%); in the remaining centers the average number of infected adults was 84.19%. In the youngest group examined (18-year-old population), the positive results were found in 46% of cases. In the successive age groups a systematic increase in the number of infected patients was observed i.e. 20–29 years of age – 54.9%; 30–39 – 67.1%; 40–49 – 76.3%; 50–59 – 91.9%; 60–69 – 93%; 70–79 – 83.9% and 80–89 – up to 100%. The highest percentage of infected persons is observed between the fifth and sixth decade of life (people born about 1945). In the individual age groups, the percentage of infected women and men was found to be comparable with a slightly higher percentage in women – by 5%. The significant differences were observed with regard to residence: the highest number of infected patients lives in provincial towns – 94.6%, followed by big towns – 74.8%, the lowest – in villages – 71.9%. The percentage of infected persons according to age systematically increases in the population living in big towns: from 62.3% in the 20–29 age group to 100% in the 9-decade group and in provincial towns: 73.9% to 100%, respectively. In the rural population an increase is observed from 65.5% in the third decade to 92.5% in the sixth one and then decreases to 75% in the ninth decade of life. The results concerning the place of birth and residence in the first years of life are different: the highest percentage of those infected with *H. p.* is observed in persons born in villages – 87.3% and in small towns – 78.4%, the lowest in big towns – 64% ($p < 0.001$). The differences between the place of birth and residence probably result from the migration from the country to towns and *vice versa*.

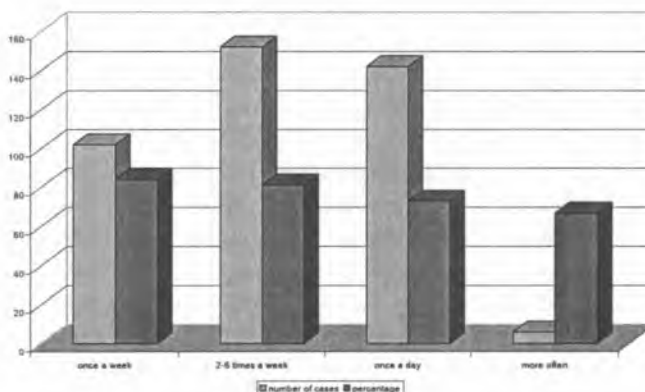
Moreover, the relation between the infection and civil status was examined – the lowest percentage of infected persons was demonstrated in single adults – 58.5%. This percentage in married persons was 80.9%, in divorcees – 88.2% (female: 100%, male: 50%), in widowed – 90.2% (female: 89.4%;

male: 100%) ($p < 0.001$). No significant correlation between the incidence of *H. p.* infection and professional activity was observed: working persons – 80%, not working ones – 77%. In the group of employed individuals, the highest number of those infected was found among farmers – 79%, the lowest – among mental workers – 75.6%. Among those unemployed, the highest percentage of infections was found among the retired and pensioners (94% and 84%), the lowest – among pupils and students – 51.7% ($p < 0.001$).

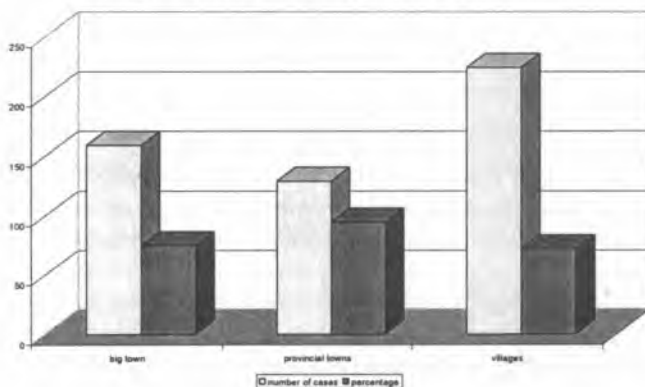
Number of cases and *H.p.* infection incidence in relation to education



Number of cases and *H.p.* infection incidence in relation to bath and shower frequency



Number of cases and *H.p.* infection incidence (%) in relation to the place of residence



The incidence of *H. p.* infection is not significantly affected by the overpopulation of flats and houses – < 10m per one family member – 68.4%, up to 20 m and above – to 78.7% ($p =$ insignificant). 78.6% of the infected lived in their own houses or flats with running water and toilets and only 66.7% did not own their flats. Considering the economic status, the population with the first group taxes included 81.3% of the infected cases, with the second – 71.4% ; a rapid increase was observed in the third group of taxes – up to 100%. The lack of money for basic needs did not affect the incidence of infections, the percentage of the infected in both cases was the same (78%). For the families without social security the percentage of the infected was 79.2% while for those on social security – 61.9%. The *H.p.* infection incidence is also unaffected by the work on the farm or allotments- those who did not work constituted 82.1% of the infected, those who worked – 76.5%. The results concerning the use of natural fertilizers are also comparable (without – 76.5%, with – 77.3%). The differences were observed among those having domestic animals (82.5% – no animals, 75.8% – with animals, $p < 0.007$). The smaller differences were found among those taking care of farm animals (79% and 76%, respectively, $p =$ insignificant).

Furthermore, the results evaluating the relation between *H. p.* infection and the place supplying meat and vegetables were comparable: 78.3%, 79% – only shops; 79.2%, 78.4% – own farms or markets. The incidence of infection was strongly affected by the consumption of raw meat: 79.2% of those not eating, 91.7% of those eating ($p = 0.007$), however, was not significantly influenced by drinking running water (79.8%, 75.6%, respectively). Moreover, the relation between infections and smoking was examined: the values found among non-smokers and smokers were similar – 77.2%, 77.4%. An increased infection incidence was observed among former smokers – 83.2%. A similar percentage of infections was found among abstinent and alcohol drinking persons: 79.0%; 78.2%. According to the kind of alcohol consumed the following values were found: lower infection percentage among those drinking beer (75.8%) compared to non-drinkers (84.9%); comparable – 79.4%, 77.0% – among those drinking wine. The highest percentage of the infected was observed in participants drinking high-grade alcohols: 82.4% compared to 67.5% among non-drinkers ($p = 0.010$). Moreover, the infection-personal hygiene relation was examined; washing hands after coming home was included: persons not washing hands – 85.7% of the infected cases; always washing hands – 78.2%, washing hands before eating: not washing – 92.9%, washing – 78.1%, washing hands after contact with animals: not washing – 86.2%, always washing – 78.2%. The infected individuals constituted 90.9% of those who did not wash fruits with running water and 78.0% of those who washed them. No significant correlation was found between the infection and tooth brushing: 66.7% of those brushing teeth rarer than once a day, 82.7% – once a day, 78.7% – twice, 72.2% – more often. A significant relationship was observed between the infection and frequency of baths and showers: once a week – 84.3%, 2–6 times a week – 81.3%, once a day – 72.8%, more often – 66.7% ($p = 0.042$). In the population examined the frequency of underwear changes was of significant importance: once a week – 88.9%, 2–6 times a week – 81.2%, once a day – 75.8%.

DISCUSSION

The adult population of the Lublin region is characterized by relatively high incidence of *H. p.* infection (78.52%). Comparing the examination results with the average national value, the percentage of the infected is lower (the infection incidence in adults is 84.19%). According to the newest studies Poland belongs to the countries of medium intensity of *H. p.* infection, i.e. 40%–60% (for adult and children populations) (5). Infections usually develop in early childhood by person-to-person contacts (3). In the examined population the number of infections in the 18–20 age group is 46% compared to 75% in the developing and 10% in the developed countries. A systematic increase in the frequency of

infections is observed with age – from 54.9% in the 20–29 age group to almost 100% in the 80–89 age group. This results from the so-called cohort effect, i.e. a particular generation has its own specific infection incidence; the higher the infection incidence in their childhood, the higher the general incidence (12). The highest increase in the number of the infected cases is observed between the fifth and sixth decade of life – the persons born about 1945–1950. This value is comparable with the results of studies conducted by Parsonnet and Cave in the United States (1).

According to the numerous studies performed, there is a reverse correlation between the *H.p.* infection incidence and socioeconomic status and education of the population in a particular country. Our studies reveal that the effects of education, professional activity and character of work (79% of the infected cases among farmers and 75% among mental workers) on the infection incidence are slight. Compared to the USA studies, 20% of the infected are among those with higher education and 50% – among those with elementary education (6). The infections are strongly affected by sanitary conditions, poor personal hygiene – washing hands, frequency of baths, underwear changes. The incidence of infections in persons lacking high personal hygiene reached 90%. It may be assumed that in such cases the faecal-oral spread predominates (dirty hands). It is believed that the risk factor of the *H.p.* infection is likely to be the system of water supply, consumption of raw fruits and vegetables and products bought from street stalls. *Helicobacter pylori* is detectable in the layer of biological water where it survives 8 days (2). In our study the place of food purchase was of no great importance – the percentage of the infected persons purchasing food in shops and those using their own supplies or market places was comparable (78.3%; 79%). However, higher incidence was associated with raw meat consumption (91.7% compared to 76.8%) while running water drinking was not significantly important (79.8%; 75.6%). The incidence of *H. p.* infection is poorly affected by smoking and alcohol consumption – the results in smokers and non-smokers are comparable (77.2%; 77.4%); however, lower infection percentage was observed among those drinking beer (75.8%; 84.9%). The consumption of wine did not show any effects. The studies conducted by Murray in Great Britain showed the reverse correlation between alcohol consumption and *H. p.* infection. The population studies were carried out in 10,537 individuals, the data concerning smoking and average week alcohol consumption were recorded. No correlation between smoking and active *H. p.* infection was demonstrated. The lower risk of *H.p.* infection was found in about 11% of the individuals consuming 3–6 units of wine or beer (11).

CONCLUSIONS

The incidence of *H. pylori* infection in the adult population of the Lublin region is relatively high although lower than that in the other Polish centers. The highest number of the infected persons live in provincial towns, the lowest – in the country. The infection incidence increases with age. The infections are likely to develop in childhood by oral-oral or faecal-oral spread. The lack of basic personal hygiene significantly affects the infection. No significant effects of economic status and education were observed.

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SUMMARY

The *Helicobacter pylori* infection is considered the most frequent factor of morbidity and mortality in the diseases of the upper alimentary tract. It is responsible for duodenal and gastric ulcers. It may contribute to the development of MALT lymphoma and gastric carcinoma. The *H.p.* infection is a widespread phenomenon, its intensification is associated with the socioeconomic status and increases with age. The aim of the study is to analyse the epidemiological trends of the *H.p.* infection, the effects of environmental factors, lifestyle, diet and sanitary habits on the incidence of *H.p.* infection in the adult population of the Lublin region. The study included 585 adults randomly chosen for epidemiological analysis within the project ordered by the Ministry of Health and State Committee for Scientific Research. The personal questionnaires were completed and serum levels of antibodies against *H.p.* were determined. The positive results were found in 78.52% of the examined participants. In the youngest group, the positive result was observed in 46% of cases. In the successive age groups a systematic increase in the number of the infected was found – from 46% to 100%. The highest number of the infected individuals live in provincial towns – 94.6%, the lowest – in the country – 71.9%. The infections are significantly affected by sanitary conditions: poor personal hygiene-the incidence about 90%. The infection incidence is also affected by alcohol consumption- increases with consumption of high-grade alcohols – 82.4% (compared to 67.5% among non-drinkers) and decreases in those drinking low-grade alcohols (beer) – 75.8% (84.9% in non-drinkers). No effects of the economic status and education on the *H.p.* infection incidence were observed.

Wpływ czynników środowiskowych na częstość zakażenia *Helicobacter pylori*
wśród populacji osób dorosłych na Lubelszczyźnie

Infekcja *Helicobacter pylori* uznawana jest za najczęstszy czynnik chorobowości i śmiertelności w schorzeniach górnego odcinka przewodu pokarmowego. Jest odpowiedzialna za występowanie wrzodów trawiennych dwunastnicy i żołądka. Może przyczyniać się do rozwoju chłoniaka żołądka typu MALT i raka żołądka. Zakażenie *Helicobacter pylori* jest zjawiskiem powszechnym, jego nasilenie związane jest ze stanem ekonomicznym społeczeństwa i narasta wraz z wiekiem populacji. Celem pracy jest analiza trendów epidemiologicznych zakażenia *Helicobacter pylori*, wpływ warunków środowiskowych, stylu życia, diety oraz nawyków higienicznych na częstość występowania zakażenia *H. pylori* wśród populacji osób dorosłych zamieszkujących województwo lubelskie. Badaniem objętych zostało 585 osób dorosłych wylosowanych do analizy epidemiologicznej w ramach projektu celowego Ministerstwa Zdrowia oraz Komitetu Badań Naukowych. Wśród osób badanych przeprowadzono kwestionariusz osobowy oraz oznaczono poziom przeciwciał przeciw *H. pylori* w surowicy krwi. Dodatni wynik testu stwierdzono u 78,52% badanych. Wśród najmłodszej grupy badanych dodatni wynik przeciwciał stwierdzany był u 46% osób. Zaobserwowano systematyczny wzrost liczby osób zakażonych w kolejnych grupach wiekowych od 46% do 100%. Najwięcej osób zakażonych zamieszkuje miasta powiatowe – 94,6%, najmniej wieś – 71,9%. Istotny wpływ na zakażenie mają warunki sanitarne: niski stopień higieny osobistej, częstość zakażenia u osób nieprzestrzegających podstawowych zasad higieny osobistej osiąga około 90%. Obserwuje się wpływ spożycia alkoholu na częstość zakażenia, wzrasta wraz ze spożyciem napojów wysokoprocentowych – 82,4% (niepijący 67,5%), spada u osób pijących alkohole niskoprocentowe (piwo) – 75,8% (grupa niepijących 84,9%). Nie obserwuje się istotnego wpływu statusu ekonomicznego i edukacji na częstość zakażenia.