

# Gastroesophageal reflux in alcohol-abusing patients

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## KEY WORDS

gastroesophageal  
reflux, hazardous  
alcohol consumption,  
screening test

## ABSTRACT

**INTRODUCTION** Consumption of large amounts of alcohol can promote regurgitation of hydrochloric acid into the esophagus and therefore cause symptoms of gastroesophageal reflux disease. Most individuals who experience alcohol-related health problems are not addicted to alcohol, but they usually show a hazardous pattern of alcohol consumption.

**OBJECTIVES** The aim of the study was to examine the gastrointestinal tract in hazardous drinkers and to establish whether such alcohol consumption pattern may be an important risk factor for developing gastroesophageal reflux.

**PATIENTS AND METHODS** Primary care patients (n = 2000; mean age 41.1 years) from Warsaw, Poland, responded to 2 surveys: AUDIT (Alcohol Use Disorders Identification Test) and Carlsson's questionnaire. Patients characterized as hazardous drinkers and having symptoms of reflux disease entered the second phase of the study: gastroscopy and pH-metry. The results were compared with those obtained in the control group (n = 60), which included patients with reflux symptoms but who abstained from alcohol or were moderate drinkers.

**RESULTS** According to the survey results, 18.75% of the study group showed a hazardous pattern of alcohol consumption, while 33% had symptoms of gastrointestinal reflux disease. A positive pH-metry result was observed in 87.5% of the hazardous drinkers. Endoscopic features of esophagitis were observed in 64% of the patient group and 28% of the control group. Hazardous alcohol consumption and male sex may be the risk factors for developing reflux-related esophagitis.

**CONCLUSIONS** Primary care physicians should routinely ask their patients about alcohol consumption. Hazardous alcohol drinking may be a risk factor for developing reflux disease.

**INTRODUCTION** The World Health Organization Report published in 2002 by the World Health Organization (WHO) showed that alcohol abuse is more dangerous than high cholesterol levels or overweight. As a morbidity factor, it is 3 times more severe than diabetes and 5 times more severe than bronchial asthma. It is estimated that 124 billion euros is spent yearly by the European Union to cover alcohol-related damage. The problem concerns a large part of the global population: according to the European Commission report, approximately 118 million of the inhabitants of Europe, or 1 in 3 adults, gets heavily drunk at least once a month.<sup>1</sup> The majority of individuals

suffering from alcohol-related health problems are not addicted, but their drinking habit can be characterized as hazardous, as confirmed by the most recent study published in 2005.<sup>2</sup>

In 1978, Kauffman and Kaye published their hypothesis that linked consumption of large amounts of alcohol to the induction of gastroesophageal reflux; their results indicated that alcohol contributes to the regurgitation of acidic gastric matter by decreasing pressure of the lower esophageal sphincter and delaying gastric emptying.<sup>3</sup> According to epidemiological studies, 30% of the population of industrialized countries are affected by gastroesophageal reflux disease,

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**TABLE 1** Characteristics of the patient groups

Alcohol consumption	No reflux symptoms	Reflux symptoms	Total
safe, n (%)	988 (71)	403 (29)	1391 (100)
hazardous, n (%)	193 (52)	176 (47)	369 (100)
harmful and major alcohol problem/addiction, n (%)	153 (64)	87 (36)	240 (100)

making this condition a serious public health issue.<sup>4</sup>

Several physiological mechanisms are involved in the prevention of gastroesophageal reflux: anatomic antireflux barrier, physiological self-emptying abilities of the esophagus leading to a prompt removal of physiological reflux by saliva, normal production of bicarbonates by esophageal submucosal glands, as well as proper stomach emptying and resistance of esophageal mucosal cells to possible damage inflicted by hydrochloric acid.<sup>5</sup> Consumption of large amounts of alcohol makes all these protective mechanisms inefficient. For example, detrimental effect of alcohol on the esophageal mucosa was shown to result from the impairment of transepithelial transport, disturbances in the physiology of intercellular junctions and weakening of the mucosal barrier, all leading to the penetration of H<sup>+</sup> ions into the mucosal layer.<sup>6</sup> Importantly, a significant increase in the frequency of postalcohol reflux episodes was observed in healthy volunteers.<sup>7,8</sup>

Several recent reports on the gastroesophageal reflux have focused either on healthy volunteers or on individuals addicted to alcohol, missing an important population of hazardous drinkers. The increasingly rapid pace of life and various socio-economic factors significantly affect increasing alcohol consumption. This has implications for primary care physicians who are responsible for the prevention of numerous conditions, particularly lifestyle diseases.

**PATIENTS AND METHODS** According to the definitions endorsed by the International Classification of Diseases (ICD-10) the term “hazardous alcohol consumption” is attributed to a pattern of alcohol intake that correlates with a high risk of developing health problems. “Harmful alcohol consumption” signifies a pattern of consumption where such health problems and complications have already occurred. In order to distinguish these patterns, we used the Alcohol Use Disorders Identification Test (AUDIT), which was created by the WHO experts. It consists of 10 questions regarding hazardous drinking, harmful drinking, and alcohol addiction. Each multiple-choice question has a set of answers with a score of 0–4 points. Individuals who scored 5 points in the first 3 questions concerning hazardous drinking or 8–17 points in the entire test were considered as hazardous drinkers. High score obtained in questions 4–6 signifies alcohol addiction (total score of 20 or higher). High score obtained in questions 7–10 suggests harmful drinking (total

score between 16 and 19). The maximum score was 40 points. Conversion of points into the actual amount of alcohol revealed that hazardous drinking could be described as more than 4 standard portions for men and more than 2 standard portions for women per day, more than 6 portions consumed on one occasion regardless of sex, or lack of at least 2 alcohol-free days per week.<sup>9</sup> One standard alcohol portion equals 10 grams of pure ethanol or 250 ml of 5% beer, 100 ml of 10% wine, and 25 ml of 40% vodka. To ensure proper conversion, these calculations were presented graphically in the questionnaire as an easy-to-interpret figure. The AUDIT has sensitivity of 92% and specificity of 94%.<sup>10</sup>

Information concerning possible symptoms of reflux disease was collected using the 9-question Carlsson’s questionnaire. The score of 4 points or more was considered positive.

The first phase of our study involved adult patients consulting primary care physicians for various reasons. To ensure their full understanding of the screening process and cooperation in responding truthfully to the questions, all patients received both questionnaires, accompanied by a written statement explaining the purpose of the study. Exclusion criteria were not used; patients who did not wish to participate in the study simply did not return the questionnaires. Patients were granted full anonymity; however, those willing to participate in the second phase were asked to leave a contact phone number. Patients identified as hazardous drinkers (5–15 points in the AUDIT) and as positive for reflux symptoms (≥4 points in the Carlsson’s questionnaire) entered the second phase of the study. They underwent 24-hour ambulatory esophageal pH-metry to confirm or exclude reflux and gastroscopy to exclude other gastric and esophageal disorders and to detect possible reflux-related complications. Esophagitis was graded according to the Los Angeles Classification.

A total of 176 patients were qualified to enter the second phase of the study, but only 102 left their contact details and 64 eventually agreed to undergo both diagnostic tests. The control group consisted of 60 individuals with a positive result in the Carlsson’s questionnaire and the score of 0–4 points in the AUDIT. Of 368 individuals, 186 left their contact details and only 60 agreed to undergo gastroscopy.

**Statistical analysis** Alcohol consumption habits self-assessed by patients were analyzed using the results of the AUDIT and presented in several

**TABLE 2** Differences in alcohol consumption patterns depending on age and sex

Alcohol consumption	Age 18–40 years			Age 41–50 years			Age >50 years		
	women	men	total	women	men	total	women	men	total
safe, n (%)	483 (46)	223 (23.5)	706 (35.3)	183 (17.4)	82 (8.6)	265 (13.2)	251 (23.9)	160 (16.9)	411 (20.5)
hazardous, n (%)	68 (6.5)	141 (14.9)	209 (10.4)	14 (1.3)	81 (8.5)	95 (4.7)	14 (1.3)	69 (7.3)	83 (4.1)
harmful and major alcohol problem / addiction, n (%)	25 (2.3)	109 (11.5)	134 (6.7)	8 (0.8)	41 (4.3)	49 (2.4)	5 (0.5)	43 (4.5)	48 (2.4)
total, n (%)	576 (54.8)	473 (49.9)	1049 (52.4)	205 (19.5)	204 (21.4)	409 (20.4)	270 (25.7)	272 (28.6)	542 (27.1)

**TABLE 3** Relationship between alcohol abuse (hazardous and harmful drinking, addiction) and the score in the Carlsson's questionnaire

Alcohol consumption	Negative score	Positive score
safe, n (%)	996 (71.45)	398 (28.55)
alcohol abuse (hazardous, harmful drinking, addiction), n (%)	338 (55.78)	268 (44.22)
total, n (%)	1334 (66.70)	666 (33.30)

**TABLE 4** Relationship between alcohol consumption pattern, age, and sex and a positive score in the Carlsson's questionnaire

n = 2000	OR [95% CI]	P
alcohol abuse vs. safe drinking	2.2 [1.8, 2.7]	<0.001
age groups		
41–50 vs. 18–40	1.7 [1.3, 2.2]	<0.001
>51 vs. 18–40	2.8 [2.2, 3.5]	<0.001
sex		0.1

Abbreviations: CI – confidence interval, OR – odds ratio

tables subdivided with respect to different consumption patterns (safe, harmful, and hazardous) according to age and sex. The  $\chi^2$  test or the Fisher's exact test was used to compare percentages in each group.

A multivariate logit regression model that takes into account the age–alcohol interaction was used to analyze the effect of age, sex, and alcohol consumption pattern on achieving a positive result in the Carlsson's questionnaire within the entire group and a positive result of gastroscopy (esophagitis) in the groups of safe and hazardous drinkers.

The positive predictive value of pH-metry was established in the group of hazardous drinkers who had a positive result in the Carlsson's questionnaire.

#### RESULTS AUDIT and the Carlsson's questionnaire

Of 2000 patients from Warsaw who initially entered the study, 1051 were women (52.55%) and 949 were men (47.45%). They were divided into 6 groups depending on the model of alcohol consumption and the presence or absence of reflux (TABLE 1).

Patients were also classified into 3 age groups: 18–40, 41–50, and >50 years. Mean age for the en-

tire population was 41.1 years (standard deviation = 15.6).

Our analysis revealed that younger individuals abuse alcohol more often than older subjects, and the difference was most pronounced when we compared patients aged 18–40 years and those aged >50 years. Alcohol abuse is much more prevalent among men than women. A significant difference was observed between the effect of sex on alcohol abuse in the age group of 18–40 years and in the remaining age groups. The correlation between hazardous drinking by men and women in the age group of 18–40 was twice smaller than in the other age groups (TABLE 2).

The results of the Carlsson's questionnaire assessing the relationship between alcohol consumption model and the occurrence of reflux symptoms are presented as table; 33.3% of the entire study population had a positive result in the Carlsson's questionnaire.

The comparison of percentages of different alcohol consumption models between positive and negative Carlsson's test results revealed statistically significant differences ( $P < 0.001$ ). The relationship between alcohol abuse (hazardous or harmful drinking and alcohol addiction presented collectively) and positive result of the Carlsson's questionnaire is presented in TABLE 3.

The percentage of positive Carlsson's results in the group of safe drinkers is 28.5%, while in the group of alcohol abusing patients it is 44.2% and is significantly higher ( $P < 0.001$ ).

Our analysis revealed that alcohol abuse is associated with more than a two-fold increase in the risk of positive score in the Carlsson's test; however, risk was not affected by sex (TABLE 4).

Of the 2000 patients who initially entered our study, 176 were characterized as hazardous drinkers and had symptoms of reflux disease; therefore, they were scheduled to participate in the second phase of the study. The final study group consisted of 64 individuals who agreed to undergo pH-metry and gastroscopy.

The control group consisted of 60 individuals who scored 5 points or less in the AUDIT but had a positive result in the Carlsson's test and subsequently underwent gastroscopy.

**TABLE 5** Prevalence of esophagitis in the study group and controls according to the Los Angeles classification

Esophagitis	Study group	Control group	Total
no esophagitis, n (%)	23 (35.94)	43 (71.67)	66 (53.23)
grade A, n (%)	23 (35.94)	12 (20.00)	35 (28.23)
grade B, n (%)	13 (20.32)	2 (3.33)	15 (12.09)
grade C, n (%)	5 (7.81)	3 (5.00)	8 (6.45)
total, n (%)	64 (100)	60 (100)	124 (100)

**TABLE 6** Multivariate model assessing the influence of age, sex, and alcohol consumption pattern on the prevalence of esophagitis

n = 124	OR (95% CI)	P
hazardous vs. safe drinking	7.34 (2.27, 23.7)	0.001
men vs. women	2.1 (0.94, 4.63)	0.07
age		>0.1

Abbreviations: see [TABLE 4](#)

**Gastroscopy** Gastroscopy showed that esophagitis was significantly more common (64% vs. 28%,  $P < 0.001$ ) and more advanced ( $P = 0.0001$ ) in the study group than in the control group, as shown in [TABLE 5](#). Alcohol consumption pattern as well as male sex constituted the two most significant factors affecting the risk of reflux-related esophagitis ([TABLE 6](#)), while age did not play any significant role.

**Assessment of pH-metry results** pH-metry test can confirm reflux in the absence of endoscopic changes. Of the 64 study patients, 56 (87.5%) were diagnosed as positive, which indicates that the positive predictive value of the Carlsson's questionnaire reached 87% in this study.

**DISCUSSION** Our analysis indicated that safe pattern of alcohol consumption was prevalent in the study population (1391 of 2000 individuals; approximately 70%). A total of 369 individuals (18%) engaged in hazardous drinking, while 240 (12%) were characterized as harmful drinkers or addicts.

Similar data was obtained in 2003, 2005, and 2008 in a series of nationwide questionnaire studies initiated by the State Agency for Prevention of Alcohol Related Problems (Państwowa Agencja Rozwiązywania Problemów Alkoholowych – PARPA). The percentage of hazardous drinkers increased by 30% in the years 2002–2005, and currently as many as 16% of the adult Polish population belong to this group. Slightly higher value obtained in our study (18%) is probably the result of stricter interpretation criteria of the AUDIT questionnaire, which involved, most importantly, separating the score for the first 3 questions (positive result from 5 points or more, while the entire test was considered positive from 8 points or more).

Nationwide studies confirm our data relating to sex. The most significant increase in hazardous drinking was observed among men (4.5 times higher levels of consumption than those observed in women), mostly inhabitants of small and

medium-size towns (population up to 200,000), and high school and university students. Our current analysis reflects a similar trend among the inhabitants of Warsaw. Young men constitute the majority of the alcohol-abusing population; however, the differences in alcohol consumption between men and women are less pronounced in the older age groups. Similarly, the results of PARPA-sponsored studies indicated that the most pronounced increase in alcohol consumption by women occurred in the age groups of 18–29 years (by 10.2%) and 30–39 years, among educated, professional women with university degrees, who consider their material status to be good. Such trend can certainly be viewed as part of the social evolution process that started in Poland in the middle of 1990s.

An increase in alcohol consumption reported by the Central Statistical Office of Poland (Główny Urząd Statystyczny – GUS) for the years 2002–2004 is even higher – almost 53% (*Statistical Yearbook*, 2005; *Internal Market*, 2004). The consumption of 100% alcohol *per capita* increased from 7.02 l in 1998 to 9.21 l in 2007. Such discrepancies can be attributed to the differences in research methods. Moreover, a self-declared consumption of alcohol is usually from 40% to 60% lower than alcohol sale data published by GUS, and it has to be taken into account while interpreting the results of various questionnaires. However, such questionnaires give us insight into alcohol consumption habits, even though the absolute levels of consumption are not necessarily truthfully reported by the participants.

Of 2000 individuals, 33.3% had a positive score in the Carlsson's test, which means that reflux is indeed a civilization disease. Such high prevalence of individuals suffering from reflux correlated with the results of an epidemiological study on 36,000 Polish individuals aged 15 years and older – more than 34% had reflux and most of the diagnosed individuals were 45–54 years old, overweight, and tobacco users.<sup>11</sup> Reflux disease is one of the most common causes of noncardiac chest pain and therefore requires an extensive differential diagnosis.<sup>12</sup> High prevalence of reflux disease is certainly the result of several lifestyle changes affecting the inhabitants of large cities, including not only alcohol consumption but also irregular meal schedule, fast food diet, lack of exercise, obesity, smoking, and stress.

Toxicity of ethanol and its metabolites can manifest itself somatically on several levels. In the case of upper gastrointestinal tract,



a one-time ingestion of large amount of alcohol decreases the pressure of the lower esophageal sphincter, slows down esophageal peristaltic and stomach emptying, decreases esophageal clearance, increases the production of gastrin and hydrochloric acid.<sup>13-15</sup> Such harmful effects of alcohol on the stomach and esophagus mucosa were confirmed in several studies,<sup>16-21</sup> and even observed in healthy volunteers in a 48-hour pH-metry assay after consuming 40 g of alcohol and the same volume of water.<sup>22</sup>

Our study shows that esophagitis is more prevalent and more severe in the group of hazardous drinkers but, importantly, the mechanisms underlying the effects of chronic alcohol abuse on esophageal motility are not yet fully understood. Some of the participants consumed smaller amounts of alcohol every day, while others severely overindulged once in a few days or weeks. Nevertheless, both patterns fulfill the criteria of hazardous drinking.

pH-metric test was performed in the study group (n = 64) and was positive in 56 individuals (87.5%). It is safe to assume that alcohol constituted one of the pathogenic factors in this group.

Our analysis revealed two statistically significant factors contributing to the development of reflux-related esophagitis, namely hazardous alcohol consumption pattern and male sex. In the present study, we did not collect data concerning other possible risk factors implicated in reflux pathophysiology, such as the body mass index, smoking, and medication; therefore, we were not able to establish whether they were independent factors. Moreover, studies published so far often disagree in their conclusions about the effect of hazardous drinking on the esophagus.

A study assessing gastroscopy results and their correlation with several lifestyle factors in healthy Chinese population revealed that esophagitis was significantly associated with alcohol abuse and male sex.<sup>23</sup> Another study focused on patients who had been abusing alcohol for the last 5 years and revealed no correlation between alcohol consumption and reflux with the exception of the subpopulation of young patients, in whom such correlation reached statistically significant levels.<sup>24</sup> Both these reports, similarly to ours, concern patients with chronic alcohol abuse. Interestingly, the second report confirmed the alcohol-reflux hypothesis only in young people, a phenomenon that can be explained first by the common practice of consuming large amounts of alcohol during the so called "binge drinking" sessions, and, second, by the lack of established tolerance to alcohol. Practically, this means that the body will attempt much earlier to switch on defense mechanisms such as vomiting, which can in turn lead to esophageal mucosal damage. The economic aspect of overprescribing endoscopic diagnostic test in young individuals with lifestyle-related reflux disease should also be taken into consideration and prompt endoscopy as an initial

test should be reserved mainly for patients aged 50 years and older, presenting with symptoms suggesting malignancy. Younger patients without any major alarming signs should not be required to undergo endoscopy as a primary management strategy.<sup>25</sup>

**Limitations of the project** Our study would certainly benefit from more detailed characterization of the study population, e.g., more data on the education level, professional life, and tobacco use. Similarly, the group of patients who underwent gastroscopy should be characterized more thoroughly with respect to tobacco use, body mass, possible infection with *Helicobacter pylori* or use of nonsteroid anti-inflammatory drugs.

Limiting the pH-metry only to the study group made it impossible to diagnose reflux in controls who did not have endoscopically visible changes in the esophagus.

Clearly, there is a need for further investigation of the above issues. Most of the reports published to date concentrate on health problems related to alcohol addiction. Hazardous drinking is a borderline phenomenon that is not considered equally important and is very difficult methodically, because even the term itself suggests potential health hazard. Nevertheless, it is certainly an important subject that requires further research, especially because the number of hazardous drinkers in Poland is four-fold higher than the number of individuals addicted to alcohol (according to PARPA).

**Conclusions** Efficient prevention of health problems related to hazardous alcohol drinking will require a change in the approach of health care professionals. Patients with so called "minor" alcohol problem (i.e., hazardous and harmful drinkers) are in a position to be influenced significantly by the primary care physician and, subsequently, to decrease their alcohol intake. According to the studies, such measure of early intervention is successful in 1 in 8 individuals, which constitutes a very high efficiency index.<sup>26</sup> Similar intervention in nicotine addiction resulted in success in 1 in every 20 patients.<sup>27</sup> According to the surveys conducted between 2002–2005 in Poland, 93% of the patients had never been questioned about their alcohol habits during medical check-up.

Primary care physicians should be encouraged to routinely use screening tests to identify alcohol-abusing individuals. Early intervention in such cases can prevent the occurrence of reflux disease, which can affect especially male hazardous drinkers.

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# Refluks żołądkowo-przełykowy u pacjentów nadużywających alkoholu

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## SŁOWA KLUCZOWE

picie ryzykowne,  
refluks żołądkowo-  
przełykowy, test  
przesiewowy

## STRESZCZENIE

**WPROWADZENIE** Konsumpcja dużych ilości alkoholu powoduje cofanie się kwasu solnego do przełyku, wywołując epizody choroby refluksowej. Większość osób mających problemy zdrowotne związane ze spożywaniem alkoholu to nie osoby uzależnione, ale ludzie pijący ryzykownie.

**CELE** Celem projektu było zbadanie przewodu pokarmowego u ryzykownie pijących osób i sprawdzenie, czy taki model picia alkoholu może być ważnym czynnikiem ryzyka występowania refluksu żołądkowo-przełykowego.

**PACJENCI I METODY** Pacjenci lekarzy rodzinnych w Warszawie (n = 2000; średnia wieku 41,1 roku) odpowiadali na 2 kwestionariusze: AUDIT (Alcohol Use Disorders Identification Test) i test Carlssona. Pacjenci zidentyfikowani jako pijący ryzykownie i mający jednocześnie objawy choroby refluksowej zostali zakwalifikowani do drugiego etapu badania – gastrokopii i pH-metrii. Wyniki badań porównano z grupą kontrolną, którą stanowiły osoby mające objawy refluksu, ale będące abstynentami lub pijące alkohol bezpiecznie (n = 60).

**WYNIKI** W oparciu o wyniki ankiet dowiedziono, że ryzykowny model picia alkoholu dotyczy 18,75% badanej populacji, a objawy choroby refluksowej stwierdzono u 33%. Wynik pH-metrii był dodatni u 87,5% osób z grupy ryzykownie pijących pacjentów. Endoskopowe cechy zapalenia przełyku rozpoznano u 64% osób z grupy badanej i u 28% z grupy kontrolnej. Ryzykowny model spożycia alkoholu i płeć męska mogą być czynnikami ryzyka refluksowego zapalenia przełyku.

**WNIOSKI** Lekarze rodzinni powinni rutynowo pytać pacjentów o picie alkoholu. Ryzykowny model picia alkoholu może być czynnikiem ryzyka choroby refluksowej.

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