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Wiener klinische Wochenschrift
The Central European Journal of Medicine

Influence of various factors on functional dyspepsia

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Summary Aim of the research is to establish the prevalence of dyspepsia in Osječko-baranjska County, to establish its specific characteristics and to determine the effect of demographic, anthropometric, and socioeconomic factors. It is a cross-sectional and case control study conducted in 2010 on systematic sample of 900 subjects between 20 and 69 years of age. Every subject was sent an invitation letter and a Rome III diagnostic questionnaire for one of the disorders. A scoring algorithm was used to confirm or exclude the diagnosis of functional dyspepsia (FD). The chi-square test, t-test and logistic regression were used for analysis.

Prevalence of dyspepsia was recorded in 16, 56 %, of subjects. There is no statistically significant difference in prevalence of dyspepsia male and female. The prevalence of dyspepsia increases with age. Correlation with the place of birth was proven. There is no correlation between the current place of residence (rural area and town) and dyspepsia. There is a correlation with marital status. Correlation between stool forms was proven. There were a greater number of subjects that had at least one alarm symptom or some of the psychosocial factors and they often suffered from a chronic disease. The risk for dyspepsia increases with age, body mass index (BMI), and poorer health. Logistic regression showed the following as statistically significant for dyspepsia: place of birth and self-assessment of one's health. FD presents a significant health problem. Rome III survey questionnaire proved to be an acceptable method for diagnosing this functional disorder in clinical-consilliary and primary health care for persons showing signs of alarm and needing further diagnostic treatment.

Keywords Dyspepsia · Prevalence · Risk factors · Guidelines for early detection · Croatia

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Introduction

Functional dyspepsia (FD), irritable bowel syndrome, and constipation are the most common functional gastrointestinal disorders and they make a wide group of different disorders of the digestive system of a relatively high incidence and prevalence in the (general) population of developed countries. According to recent studies, one in four people of modern Western countries have symptoms of functional gastrointestinal disorders [1]. According to the Rome III diagnostic criteria, FD is defined as a permanent or temporary uncomfortable bloating after meals, as early satiation, or epigastric pain or burning sensation in the epigastrium which linger in the past 3 months, starting from 6 months before diagnosis, and are present in more than 25 % of the time. If the results of the scoring algorithm confirmed the diagnosis of FD without alarm symptoms and if medical history and examination

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excluded suspected organic disease, further diagnostic tests may not be required [2–4]. In about 30–60 % of dyspeptic patients, diagnostic procedures cannot reveal organic background of dyspepsia [5]. Large population studies have shown that dyspepsia and FD are very common diseases. Depending on the definition of dyspepsia, prevalence of dyspepsia varies between 7 and 45 % and prevalence of FD between 11and 29.2 % [6]. There are not much data on the incidence of dyspepsia. The incidence of dyspepsia, for example, in Sweden amounts 15.3 per 1000. The incidence is higher in people with sleep disorders, angina pectoris, rheumatoid arthritis, smokers, and people with generalized pain [7].

There are no large population studies in Croatia, as well as in the world, which determine the impact of various factors on FD syndrome and show the differences in the representation of this functional disorder in certain geographic areas.

In our country, there are no data on the characteristics of FD, and the influence of various factors on the prevalence of FD.

The aim of this study was to detect the prevalence of FD in Croatia in the Osječko-baranjska County and to determine the impact of various anthropometric, demographic, socioeconomic, and psychosocial factors on its occurrence.

Patients and methods

This cross-sectional and case-control study was conducted on population, aged from 20 to 70 years, which were insured at the Regional Office of the Croatian Health Insurance in Osijek. Participants were chosen by the method of systematic sampling (900 of them to get answers from at least 600 patients) in 12 urban and 6 rural primary care facilities in Osječko-baranjska County in Croatia. The first participant was randomly selected and was followed by every tenth patient in the file, according to alphabetic order.

The control group was a group of the same gender, similar age, urban or rural areas of housing, education and without the symptoms of FD.

Each subject received to his or hers home address an invitation letter and Rome III diagnostic questionnaire for dyspepsia with a request to complete the questionnaire and to send it back in the enclosed and addressed envelope [8–10].

The diagnosis of FD is established based on the answers to the questionnaire if the following Rome III criteria are met:

- Uncomfortable bloating after the medium large meal more than 1 day/week
- Inability to complete the medium large meal, more than 1 day/week
- Pain or burning sensation in the middle of the abdomen, at least 1 day/week

lasting for the last 3 months, starting 6 months before diagnosis and are present in more than 25 % of the time.

If the answers from the questionnaire met the criteria for dyspepsia, without alarm symptoms and, if medical history and clinical examination exclude the suspicion of organic disease, further diagnostic tests are not necessary.

By scoring the responses to questions from the Psychosocial Alarm Questionnaire for the Functional GI Disorders for the anxiety and depression we obtained the indication for referring the individual to the specialist who deals with mental health.

Statistical analysis

Most of the variables of the questionnaire are nominal variables. In order to determine their relationship, we made the intersection the variables. The dependence or independence of two nominal variables can be obtained from the analysis of their contingency tables using the χ^2 test. We used the *t*-test to analyze the following variables in patients with FD comparing to patients without FD: gender, age, height, weight, education, occupation, residence, economic status, living in the household, presence of chronic diseases, satisfaction with health status and psychosocial disorders. We used the logistic regression to examine the risk of appearance of dyspepsia syndrome in relation to the correlated variables.

The software SPSS Statistics 17.0 and Statistica 8.0 were used. Graphical presentations were made by using Microsoft Excel 2003 and Statistica 8.0 application. These applications were installed at the Department of Physics, University of Josip Juraj Strossmayer in Osijek.

A *p*-value of <0.05 was considered statistically significant.

Results

There were 663 participants involved in the research on FD (73.66 % of the polls were taken back in need of further processing), 317 or 47.81 % among them male and 346 or 52.19 % female participants (Table 1). There was not much difference in average age between male and female participants. Since the youngest participant of all three groups was 20 years old, and the oldest one was 69, the average age of participants was set to 43.59. Table 2 shows distribution according to age groups and symptoms of dyspepsia. Testing with chi-squared test shows that it is acceptable to assume dependences between the age groups when both genders are being considered which refers to both male and female participants. Chi-squared test confirms the existence of dependences between the place of birth and the symptoms of dyspepsia when observing both genders together, as well as when observing male participants (Table 3). Our findings show that there is no relationship between the current place of residence and the risk of dyspepsia, which is shown in Table 4.

Table 1 Distribution of participants according to gender and symptoms of dyspepsia

Sample	Gender	With symptoms		Without symptoms		Total	p^a
		N	%	N	%	N	
Dyspepsia	M	50	**15.8**	267	84.2	317	>0.05
	F	60	**17.3**	286	82.7	346	
	T	110	**16.6**	553	83.4	663	
[a]p for χ^2-test							

Table 2 Distribution of participants according to age groups and symptoms of dyspepsia

Sample	Gender	Age groups											p^c
		20–34 years			35–49 years			50–69 years			Total		
		Yes[a]	%	N^b	Yes[a]	%	N^b	Yes[a]	%	N^b	Yes[a]	%	N^b	
Dys-pepsia	M	8	7.5	107	19	19.4	98	23	20.5	112	50	15.8	317	<0.05
	F	12	11.9	101	17	14.8	115	31	23.8	130	60	17.3	346	<0.05
	T	20	9.6	208	36	16.9	213	54	22.3	242	110	16.6	663	<0.01

[a]Yes number of people with the symptoms of dyspepsia
[b]N total number—with and without symptoms
[c]p for χ^2-test

Table 3 Distribution of participants according to whether they were born in Slavonija area and dyspeptic symptoms

Sample	Gender	Born in Slavonija area			Born outside of Slavonija area			Total			p^c
		Yes[a]	%	N^b	Yes[a]	%	N^b	Yes[a]	%	N^b	
Dyspepsia	M	**34**	**13.4**	**254**	**16**	**25.4**	**63**	**50**	**15.8**	**317**	**<0.05**
	F	42	16.2	259	18	20.7	87	60	17.3	346	>0.05
	T	**76**	**14.8**	**513**	**34**	**22.7**	**150**	**110**	**16.6**	**663**	**<0.05**

[a]Yes number of people with the symptoms of dyspepsia
[b]N total number—with and without symptoms
[c]p for χ^2-test

Table 4 Distribution of participants according to the current place of residence (rural area and town) and symptoms of dyspepsia

Sample	Gender	Current place of residence									p^c
		Rural area			Town			Total			
		Yes[a]	%	N^b	Yes[a]	%	N^b	Yes[a]	%	N^b	
Dyspepsia	M	21	17.2	122	29	14.9	195	50	15.8	317	>0.05
	F	22	17.2	128	38	17.4	218	60	17.3	346	
	T	**43**	17.2	250	**67**	16.2	413	**110**	16.6	663	

[a]Yes number of people with the symptoms of dyspepsia
[b]N total number—with and without symptoms
[c]p for χ^2-test

No confirmation was made on dependences between the level of education and the symptoms of dyspepsia when both genders are being consider, which refers to both male and female participant (Table 5). According to marital status, the highest proportion of participants who are at risk of dyspepsia comes from a group of widowers. There is not a single person with dyspeptic symptoms that came from extramarital cohabitation. Chi-squared test shows the existence of dependences between marital status and the risk of dyspepsia. Dependence between unmarried participants and the symptoms of dyspepsia has not been proved. The independence of analyzed features was also confirmed with the use of Yates' correction (Table 6). According to t-test results, people with symptoms of dyspepsia are older on average, have higher body mass index (BMI) and they also assess their health status with lower ratings (Table 7). Logistic regression showed the following as statistically significant for dyspepsia:

Table 5 Distribution of participants according to level of education and symptoms of dyspepsia

Level of education	Gender	Dyspepsia		
		Yes[a]	%	N[b]
Uncompleted elementary school	M	2	33.3	6
	F	1	14.3	7
	T	3	23.1	13
Elementary school	M	3	10.7	28
	F	17	30.4	56
	T	20	23.8	84
High school	M	30	15.7	191
	F	30	15.9	189
	T	60	15.8	380
Bachelor	M	6	20.7	29
	F	3	11.5	26
	T	9	16.4	55
University	M	9	14.3	63
	F	9	13.2	68
	T	18	13.7	131
Total	M	50	15.8	317
	F	60	17.3	346
	T	110	16.6	663
p[c]	M	>0.05		
	F			
	T			

[a]Yes number of people with the symptoms of dyspepsia
[b]N total number—with and without symptoms
[c]p for χ^2-test

Table 6 Distribution of participants according to marital status and symptoms of dyspepsia

Marital status	Dyspepsia		
	Yes[a]	%	N[b]
Single	17	10.9	156
Married	76	19.0	400
Extramarital cohabitation	0	0.0	23
Divorced	6	14.3	42
Widow/widower	11	26.2	42
Total	110	16.6	663
p[c]	<0.05		

[a]Yes number of people with the symptoms of dyspepsia
[b]N total number—with and without symptoms
[c]p for χ^2-test

place of birth and self-assessment of one's health. People born outside of Slavonija area have 1.662 times a bigger chance of being at risk in comparison with the people born in Slavonija. And if the self-assessed health status increases by one grade (from very dissatisfied to very satisfied), the chance of risk will be reduced by 0.553 times (Table 8). According to the t-test results there are significant statistical differences, comparing people with dys-

peptic symptoms and people without those symptoms, between average scores of blood in the stool in the last 3 months, black stool in the last 3 months and difficulties in swallowing in the last 3 months, for people at risk of dyspepsia (Table 9). Chi-squared test shows the existence of dependence between being anemic and symptoms of dyspepsia (Table 10). There is a slightly higher proportion of participants with symptoms of dyspepsia with unintentional weight loss in the past 3 months (=>4.5 kg) as compared to participants with dyspepsia who have not unintentionally lost that much weight, however, due to failure to satisfy assumptions, statistical testing could not have been made (Table 11). Chi-squared test shows that dependence exists between feeling tension, feeling indisposed and miserable, feeling hopeless and symptoms of dyspepsia, as well as between desire to commit suicide, presence of pain interfering with normal activities, harassment and dyspeptic symptoms in participants. There is a larger proportion of participants with dyspeptic symptoms who had severe physical pain during the 4 weeks preceding the survey, compared to the participants with dyspeptic symptoms without severe pain, but because dissatisfied assumptions, we could not perform statistical testing (Table 12). Chi-squared test shows that the dependence between stool forms and symptoms of dyspepsia can be accepted (Table 13). Subjects with symptoms of dyspepsia were often treated for the following chronic diseases: diseases of the digestive system in 66.7%, mental illness in 46.15%, respiratory diseases in 40.00%, diabetes in 27.27%, and for musculoskeletal diseases in 22.22% of the cases. Drugs were taken for diseases of the digestive system in 62.22%, for mental illness in 58.82%, for respiratory diseases in 40%, for diabetes in 33.33%, and for musculoskeletal diseases in 20.00% of the cases.

Discussion and conclusion

Large population studies have shown that dyspepsia and FD are very common diseases. Only 20–25% of patients with dyspepsia ask for medical help, but 40% of patients in gastroenterology policlinic suffer from dyspepsia. There are not much data on the incidence of dyspepsia. Depending on the definition of dyspepsia, as well as on organization of population studies, prevalence of dyspepsia varies between 7 and 45% and prevalence of FD between 11 and 29.2%. For example, the prevalence of dyspepsia in the Czech Republic was recorded in 17% of participants, in Denmark 24.9%, in New Zealand 34.2%, in Argentina 29.6%, in Malaysia 24.3%, and in Western Europe about 15%, respectively [11–16]. In our study, dyspepsia was observed in 110 participants (16.56%), 50 males (15.77%) and 60 (17.34%) female. Numerous studies suggest the following risk factors for of FD: female gender, family history, psychiatric and other chronic diseases, the result of acute gastrointestinal infections, obesity, higher education, poor socioeconomic status, smoking, frequent use of caffeine and NSAIDs, positive Helicobacter pylori status, and some

Table 7 Basic descriptive statistical indicators together with *t*-test results

Dyspepsia						
Variable	Symptoms of dyspepsia				*t*-test	
	No		Yes		*t*	*p*
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
Age	**42,750**	**14,206**	**47,827**	**12,800**	**−3.728**	**0.000**
Years living at the current place of residence	30,538	16,257	32,425	16,928	−1.081	0.280
Height (cm)	173,161	9.696	171,455	9.471	1.692	0.091
Weight (kg)	76,635	14,477	78,091	16,383	−0.942	0.347
BMI (kg/m²)	**25,501**	**4.111**	**26,440**	**4.500**	**−2.153**	**0.032**
Number of household members	3.069	1.535	3.355	1.583	−1.774	0.077
Assessment of household financial status	3.031	0.690	2.964	0.663	0.938	0.349
Self-assessment of one's health	**3.727**	**0.825**	**3.209**	**0.996**	**5.114**	**0.000**

Table 8 Logistic regression model parameters—dyspepsia

Dyspepsia						
Constant and variables	B	Standard error	Wald	Degree of freedom	*p*	Exp(B)
Constant	20,817	12,845	2.626	1	0.105	1.10E+09
Gender: female	0.086	0.34	0.065	1	0.8	1.090
Age	0.017	0.012	2.146	1	0.143	1.017
Place of birth: outside Slavonija area	**0.508**	**0.251**	**4.089**	**1**	**0.043**	**1.662**
Current place of residence: town	0.263	0.24	1.193	1	0.275	1.300
Height	−0.13	0.075	3.034	1	0.082	0.878
Weight	0.145	0.082	3.143	1	0.076	1.155
BMI	−0.401	0.239	2.809	1	0.094	0.670
Level of education			0.88	4	0.927	
Elementary school	−0.299	0.76	0.154	1	0.695	0.742
High school	−0.288	0.762	0.142	1	0.706	0.750
Bachelor	−0.597	0.84	0.506	1	0.477	0.550
University	−0.199	0.81	0.06	1	0.806	0.820
Marital status			0.46	4	0.977	
Married	−0.095	0.375	0.065	1	0.799	0.909
Extramarital cohabitation	−19,199	8243,037	0	1	0.998	0.000
Divorced	−0.228	0.569	0.16	1	0.689	0.796
Widow/widower	0.134	0.592	0.051	1	0.821	1.144
Number of household members	0.14	0.074	3.614	1	0.057	1.150
Assessment of material status	0.056	0.173	0.104	1	0.747	1.058
Self-assessment of one's health	**−0.593**	**0.127**	**21,793**	**1**	**0.000**	**0.553**

Table 9 Basic descriptive statistical indicators with *t*-test results—alarm symptoms

Dyspepsia	Symptoms of dyspepsia				*t*-test	
	No		Yes		*t*	*p*
	Arithmetical mean	Standard deviation	Arithmetical mean	Standard deviation		
Presence of blood in the stool	**1.061**	**0.269**	**1.218**	**0.496**	**−3.224**	**0.002**
Black stool	**1.080**	**0.314**	**1.291**	**0.564**	**−3.813**	**0.000**
Blood vomiting	1.002	0.043	1.009	0.095	−0.786	0.434
Difficulties in swallowing	**1.114**	**0.371**	**1.427**	**0.795**	**−4.047**	**0.000**

Table 10 Distribution of participants according to being anemic and symptoms of dyspepsia

Dyspepsia						*p*
Being anemic	Symptoms of dyspepsia					
	No		Yes[a]		Total	
	N[b]	%	N[b]	%	N[b]	
No	508	84.8	91	15.2	599	<**0.01**
Yes	45	70.3	19	29.7	64	
Total	553	83.4	110	16.6	663	

[a]Yes = number of people with symptoms of dyspepsia
[b]N = total number—with and without symptoms

Table 11 Distribution of participants according to whether they have unintentionally lost weight of more than 4.5 kg in the past 3 months and symptoms of dyspepsia

Dyspepsia						
Unintentional weight loss	Symptoms of dyspepsia					
	No		Yes[a]		Total	
	N[b]	%	N[b]	%	N[b]	
No	529	83.4	105	16.6	634	–
Yes	24	82.8	5	17.2	29	
Total	553	83.4	110	16.6	663	

[a]Yes = number of people with symptoms of dyspepsia
[b]N = total number—with and without symptoms

Table 12 Distribution of participants according to psychosocial disorders and symptoms of dyspepsia

Dyspepsia						*p*
	Symptoms of dyspepsia					
	No		Yes[a]		Total	
	N[b]	%	N[b]	%	N[b]	
Tension						<**0.01**
No	489	87	73	13	562	
Yes	64	63.4	37	36.6	101	
Total	553	83.4	110	16.6	663	
Misery and indisposition						<**0.01**
No	506	86.3	80	13.7	586	
Yes	47	61	30	39	77	
Total	553	83.4	110	16.6	663	
Suicidal wish						<**0.05**
No	527	84.3	98	15.7	625	
Yes	26	68.4	12	31.6	38	
Total	553	83.4	110	16.6	663	
Severe physical pain						–
No	543	84.4	100	15.6	643	
Yes	10	50	10	50	20	
Total	553	83.4	110	16.6	663	
Pain that interferes with everyday activities						<**0.01**
No	537	85.1	94	14.9	631	
Yes	16	50	16	50	32	
Total	553	83.4	110	16.6	663	
Hopelessness						<**0.01**
No	481	87	72	13	553	
Yes	72	65.5	38	34.5	110	
Total	553	83.4	110	16.6	663	
Harassment						<**0.01**
No	519	84.5	95	15.5	614	
Yes	34	69.4	15	30.6	49	
Total	553	83.4	110	16.6	663	

[a]Yes = number of people with the symptoms of dyspepsia
[b]N = total number—with and without symptoms

psychosocial factors [6, 12, 17]. Our study showed no statistical significant difference between genders in dyspeptic patients, whereas in other countries data suggest female predominance, for example, on Iceland (20.2 % female and 12.3 % males) [18], in Canada [19], in Iran (8.5 % in women and 6.4 % in men) [20], as well as in other population studies[6]. Our findings show that the symptoms of dyspepsia increase with age, unlike the studies that were conducted in Italy, New Zealand and the USA, which did not show correlation between age and dyspeptic symptoms [13, 21, 22]. There is a larger proportion of dyspeptic patients that were born outside the Slavonia region comparing to the ones that were born in Slavonia, which applies to men and women separately, but for the female group the difference is not statistically significant. There are more patients of both sexes and man separately that live in countryside compared to patients that live in the city. The proportion of dyspeptic female that live in the countryside comparing to the ones that live in the city is equable, but these results show no statistical significance. In our study, there is a correlation between marital status and the symptoms for dyspepsia. The most patients belong to the widowers/widows group. Results of the study that was conducted in Iran also showed that widows often show symptoms of dyspepsia [20]. A correlation between the single status and dyspeptic symptoms was not proven. The largest proportion of participants with symptoms of dyspepsia was found in the group with a primary school and without primary school and the lowest in the group with a university degree, but

the relation between the level of education and dyspeptic symptoms was not statistically significant. The results from other countries are different. Researches from Argentina found that the risk for dyspepsia is associated with higher education level, while in Iran lower educated more suffer from dyspepsia [20]. Researches from Italy did not confirm the relation between the level of education and dyspeptic symptoms [21]. According to the *t*-test, the risk for dyspepsia includes older age, higher BMI, and poorer health. Logistic regression showed the following as statistically significant for dyspepsia: place of birth and self-assessment of one's health. People who were born outside the Slavonija region have 1.662 time higher risk of dyspepsia comparing to the ones that were born in Slavonija. And if the self-assessed health status increases by one grade (from very dissatisfied to very satisfied), the chance of risk

Table 13 Distribution of participants according to stool forms and symptoms of dyspepsia

Stool forms	Dyspepsia		
	Yes[a]	%	N[b]
Hard	15	20.8	72
Soft	80	14.9	536
Mushy	14	40.0	35
p[c]	<**0.01**		

[a]YES number of people with the symptoms of dyspepsia
[b]N total number—with and without symptoms
[c]p for χ^2-test

will be reduced by 0.553 times. Correlation between stool forms according to Bristol Stool Form Scale [23] and dyspepsia was proven. Majority of dyspeptic patients were those with diarrhea, unlike those who had soft stool. There were more subjects that had at least one alarm symptom or some of the psychosocial factors and they often suffered from a chronic disease. Correlation between psychosocial disorders and dyspepsia was found in many studies, for example, in Argentina [14], Canada [19], Sweden [7], Taiwan [24], UK [25], and Iran [20]. In a study that was conducted in the USA among African-American and Hispanic patients alarm symptoms (age above 50 years, loss of appetite, early satiety, weight loss, dysphagia, gastrointestinal bleeding, and/or anemia) increase the probability of organic etiology [26], which emphasizes the need for the further endoscopic and other diagnostic procedures.

Scientific contribution of our research is in determining the prevalence of FD, its specific characteristics and determination of demographic, anthropometric, and socioeconomic factors to the observed syndrome. The results are original and regionally specific because until now there were no such data for our region which is of a great importance for the practice. The high prevalence of dyspepsia indicates the need for further investigations, not only in other Croatian regions, but also in the world, so that data could be compared with each other, which would be helpful in creating a plan for prevention and early detection of this functional disorder.

Conflict of interest
B. Ebling, D. Jurcic, K. Majstorovic Barac, A. Bilic, I. Bajic, M. Martinac, S. Pribic, and A. Vcev declare that there are no actual or potential conflicts of interest in relation to this article.

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