

Nutritional Risk Screening and Prevalence of Malnutrition on Admission to Gastroenterology Departments: A Multicentric Study

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Rezumat

Riscul nutrițional și prevalența malnutriției la pacienții internați în clinicile de gastroenterologie: un studiu multicentric

Premize și obiective: Prevalența malnutriției la pacienții internați în clinicile de gastroenterologie este puțin cunoscută. Deoarece o parte dintre acești pacienți vor necesita tratament chirurgical iar malnutriția este un factor de risc cunoscut pentru morbiditatea perioperatorie, am realizat un studiu prospectiv cu scopul de a determina riscul nutrițional precum și prevalența și factorii de risc ai malnutriției la pacienții internați în centrele de gastroenterologie din România.

Metode: Pacienții internați consecutiv în 8 centre de gastroenterologie într-o perioadă de 3 luni au fost incluși. Riscul nutrițional a fost evaluat folosind scorul NRS 2002. Malnutriția a fost definită folosind IMC (indexul de masă corporală) <20 kg/m² și/sau >10% scădere ponderală în interval de 6 luni.

Rezultate: 3198 pacienți au fost evaluați, 51,6% bărbați și

48,4% femei, cu vârsta medie 54,5 ± 14,3 ani. În general, proporția de pacienți cu risc nutrițional a fost de 17,1%, cel mai mare risc fiind notat la pacienții cu boală hepatică avansată (49,8%), cu afecțiuni oncologice (31,3%), boli inflamatorii intestinale (20,2%) și cu afecțiuni pancreatice (18,9%). Prevalența malnutriției în lotul studiat a fost de 20,4%, mai mare în rândul pacienților cu boli hepatice avansate (39,4%), boli inflamatorii intestinale (30,6%), neoplazii (26,8%) și afecțiuni pancreatice (23%). Factori de risc independenți pentru malnutriție au fost: vârsta tânără ($p < 0,0001$), sexul feminin ($p < 0,0001$), un scor NRS înalt (≥ 3) ($p < 0,0001$), prezența unei neoplazii ($p < 0,0001$), a afecțiunilor hepatice avansate ($p = 0,003$) și reducerea aportului alimentar cu peste 25% ($p < 0,0001$).

Concluzii: Unul din cinci pacienți internați în clinicile de gastroenterologie ar putea beneficia de o intervenție nutrițională promptă. Corectarea statusului nutrițional este obligatorie înaintea oricărei intervenții chirurgicale. Evaluarea stării de nutriție la internare și inițierea terapiei nutriționale sunt imperios necesare pentru pacienții cu boli hepatice avansate, neoplazii digestive, boli inflamatorii intestinale și afecțiuni pancreatice.

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Cuvinte cheie: prevalență, malnutriție, departamente de gastroenterologie, NRS 2002, IMC

Abstract

Background and aims: There is little awareness and a lack of data on the prevalence of hospital malnutrition in gastro-enterology departments. Since part of these patients are referred for surgical treatment and poor nutritional status is a known risk factor for perioperative morbidity, we conducted a prospective study aimed to screen for the nutritional risk and assess the prevalence and risk factors of malnutrition in gastro-enterology departments in Romania.

Methods: We included patients consecutively admitted to 8 gastroenterology units over a period of three months in our study. Nutritional risk was evaluated using NRS 2002. Malnutrition was defined using BMI ($<20 \text{ kg/m}^2$) or/and $>10\%$ weight loss in the last six months.

Results: 3198 patients were evaluated, 51.6% males and 48.4% females, with the mean age of 54.5 ± 14.3 years. Overall percentage of patients at nutritional risk was 17.1%, with the highest risk for patients with advanced liver diseases (49.8%), oncologic (31.3%), inflammatory bowel diseases (20.2%), and pancreatic diseases (18.9%). The overall prevalence of malnutrition was of 20.4%, higher for advanced liver diseases (39.4%), inflammatory bowed diseases (30.6%), oncologic (26.8%) and pancreatic diseases (23%). Independent risk factors for malnutrition were younger age ($p < 0.0001$), female gender ($p < 0.0001$), a higher (≥ 3) NRS ($p < 0.0001$), presence of neoplasm ($p < 0.0001$), of advanced liver disease ($p = 0.0003$) and a reduction of $> 25\%$ of dietary intake ($p < 0.0001$).

Conclusions: One in five patients admitted to gastroenterology units could benefit from prompt nutritional intervention. Correction of nutritional status is mandatory before any surgical procedure. Emphasis on nutritional evaluation at admission and beginning of nutritional therapy where needed are particularly required in patients with advanced liver diseases, digestive neoplasms, inflammatory bowel diseases and pancreatic diseases.

Abbreviations: NRS= nutritional risk score, BMI = body mass index, IBD = inflammatory bowel diseases

Key words: prevalence, malnutrition, gastroenterology department, NRS 2002, BMI

Introduction

Disease associated malnutrition is a global health burden and serves as a major risk factor for unfavorable disease outcome and death. Up to 50% of adult patients admitted on medical and surgical wards can have clinical, hematological, biochemical or anthropometric evidence of protein energy malnutrition depending on hospital setting, patients' population and the criteria used for the definition of malnutrition (1-4). A special report of the Council of Europe highlighted major deficits in nutritional management of adult patients in European hospitals, indicating that a proportion of 20-30% of adult patients are malnourished at hospital admission and this

worsens if untreated during hospital stay (5). Malnutrition is a frequent consequence of chronic diseases and significantly affects the patients' outcome and quality of life. The association between malnutrition and increased morbidity, prolonged hospital stay, and poor survival is well established, especially for elderly, chronic organ failure and oncologic patients (6-9). Despite such compelling evidence, malnutrition often remains undetected and untreated because of lack of awareness, insufficient knowledge and training among clinicians (10).

As a result of digestive organ involvement in food intake, digestion, absorption and metabolism of nutriment, malnutrition is expected to be a common finding in gastrointestinal, hepato-biliary and pancreatic diseases. Despite this, many gastroenterologists still do not assess their patient's nutritional status and do not make nutritional therapy a major component of their patient's medical plan. There is little awareness and a lack of data on the nutritional risk and on the prevalence of hospital malnutrition in gastroenterology units in Romania. Therefore, we conducted a prospective study aimed to screen for the nutritional risk as well as to assess the prevalence, severity and risk factors of malnutrition on admission in 8 gastroenterology departments from Romania.

Materials and Methods

Study population

This was a cross-sectional, observational, multicenter study. The nutritional status of 3479 consecutively admitted adult patients was evaluated prospectively in 8 gastroenterology departments participating in this study (Fig. 1). The recruitment period lasted 3 months in all study centers. Adult (above 18 years old) hospitalized patients were considered eligible if they were willing and able to give informed consent, and if their hospital stay was longer than 2 days. Patients in coma, with impaired mental status (hepatic encephalopathy), patients transferred to ICU or surgical departments in the day



Figure 1. Geographical distribution of the eight gastroenterology departments (red spots) participating in the study

of admission (precluding nutritional evaluation) and also patients admitted for limited observation after invasive procedures or treatments were excluded from the study.

Age, gender, body weight and height, were noted on the day of admission. Body weight was measured in light clothes and without shoes using calibrated electronic scales, standard equipment available at each center. Height was measured without shoes using a wall-mounted Harpenden stadiometer or bodymeter measuring tape with wall stop, to the nearest 0.1 cm three times to ensure accuracy of measurements. If there was a discrepancy of more than 1.0 cm in one measurement, then the remaining two were averaged and recorded. If all measurements were within 1.0 cm of each other, the mean of the three measurements was used. Weight and height were used to calculate Body Mass Index (BMI) using the standard formula: $BMI = \text{weight (kg)} / \text{height (m}^2\text{)}$.

Diagnosis code according to International Classification of Maladies (ICM10), medical history and gastrointestinal symptoms were recorded in a dedicated database. By grouping diagnosis codes according to ICM10, 7 classes of digestive pathology were defined: 1) functional gastrointestinal disorders (K 30, K 31, K 58, K 59), 2) acute and chronic pancreatic diseases (K85, K 86), 3) advanced liver disease (Child B and C liver cirrhosis, K70 K74), 4) other hepato-biliary diseases (Child A cirrhosis, pre-cirrhotic stages of viral, alcoholic, autoimmune, genetic, and metabolic diseases of the liver, biliary disorders; B18, K 70, K 72, K67, K80, K81, K 83), 5) digestive oncology (C), 6) inflammatory bowel diseases (Crohn's disease and ulcerative colitis; K50, K51), 7) organic gastrointestinal and colonic diseases other than cancer or IBD (D12, D13, D15, D18, D 37, D64, I84, K 20-27, 31, 44, 52, 91).

Nutritional assessment

Nutritional Risk Screening

On the day of admission, Nutrition Risk Screening (NRS-2002) was assessed. NRS 2002 represents a screening tool recommended by ESPEN for hospitalized patients (13). The Initial NRS consists of four questions regarding BMI, weight loss, dietary intake, and severity of disease (based on increased nutrition requirements and/or metabolic stress) respectively. For each patient a detailed interview was performed by dedicated members of the study team, regarding usual weight and patients' history of weight loss in the last six months with particular emphasis on the last three months; also, alimentary habits and recent (in the last week) food intake changes were noted. The percentage of unintentional weight loss before admission was calculated based on the patient's report. If the answer was "no" to all questions, the patient was not considered at nutritional risk. If the answer to any of these questions is "yes", the Final NRS was performed, thus resulting the final score which combines two scores: the nutritional risk score (0-3) and the severity of disease score (0-3), with the addition of one point if the patient's age is over 70 years. Nutritional score: weight loss > 5% in 3 months or food intake below 50-75% in the preceding week = 1 point.

Weight loss > 5% in 2 months or BMI 18.5-20.5 kg/m² and impaired general condition or food intake 25-60% in the preceding week = 2 points. Weight loss > 5% in one month or > 15% in 3 months or BMI < 18.5 kg/m² and impaired general condition or food intake 0-25% in the preceding week = 3 points. The disease score was graded according to clinical judgment: patients admitted with complications of chronic disease (infections, mild-moderate flares of inflammatory bowel diseases) but still ambulatory, received one point, while acute severe superimposed complications which led the patient bedridden (ex: variceal hemorrhage in cirrhotic patients, severe infections, severe flares of inflammatory bowel diseases, severe chemotherapy associated nausea and/or vomiting in oncologic patients) were graded with 2 points. None of our patients received a score 3 for severity of disease since we did not include patients admitted to ICU. The maximal value for NRS 2002 is 7. Patient is considered at nutritional risk when the final result is equal to or more than 3. NRS 2002 classified patients in two categories: at nutritional risk and without nutritional risk.

Definition and grading of malnutrition

We classified the patients as having PEM (protein energy malnutrition) if one or more of the following criteria were fulfilled: 1) unintentional weight loss > 10% body weight during the previous 6 months preceding hospital admission; 2) BMI < 20; Malnutrition was graded as severe if BMI < 16 kg/m².

Statistical analysis

Results were presented as mean $\pm$ standard deviation (SD) unless otherwise specified. Categorical data are described as frequencies of the subjects with a specific characteristic. Chi-square test was used for comparing categorical data and Student's t-test or Mann-Whitney-U-test, when appropriate, was used for comparing continuous variables. Spearman's rank correlation coefficient was used to measure the degree of association between two quantitative variables. Univariate and multivariate analysis were performed to identify potential predictors of malnutrition. Two-tailed p values less than 0.05 were considered statistically significant. Statistical analysis was performed using SPSS software version 12.0 (SPSS Inc., Chicago, IL, USA).

The study was conducted in accordance with the Declaration of Helsinki, approved by the ethical advisors of the Romanian Society of Gastrointestinal Endoscopy, as well as local ethical committees of each hospital involved in the study, and all patients provided written informed consent before study entry.

Results

Patients' characteristics

Of the 3479 patients who were eligible to take part in the

study, 3198 patients (91.9%) were included in the final analysis. Two hundred and eighty one patients did not participate for the following reasons: 171 refused consent, 74 were considered too ill by hospital staff, 36 were bedridden and could not be weighted and measured. The final study population consisted in 1650 (51.6%) males and 1548 (48.4%) female patients, with the mean age of 54.5 ± 14.3 years (range 18-83 years). Number of patients included in each gastroenterology department was as follows: 59 (1.9%) Arad, 2152 (67.3%) Bucharest, 113 (3.5%) Cluj Napoca, 51 (1.6%) Constanta, 76 (2.4%) Craiova, 161 (5%) Sibiu, 143 (4.5%) Targu Mures, and 443 (13.8%) Timisoara. Number of patients included at each center was proportional to those admitted during the study period. Overall, the most frequent pathologies that required hospitalization in our country were hepato-biliary pathology – advanced liver disease – 203 patients (6.3%), other hepato-biliary diseases 1090 (34.4 %), followed by organic gastrointestinal and colonic diseases other than cancer or IBD 740 (23.1%), malignant digestive diseases 737 (23%), functional gastrointestinal disorders 257 (8%), IBD 98 (3%), acute and chronic pancreatic diseases 73 (2.2%). Table 1 shows the main demographic features of study population, by center, while Fig. 2 shows the distribution of patients within the 7 pathology classes in each center.

Prevalence and severity of malnutrition

Overall percentage of patients at nutritional risk according to NRS 2002 was 17.1% (NRS score ≥ 3). Our results show that 49.8 % of patients with advanced liver diseases (liver cirrhosis Child-Pugh class B and C) had a NRS ≥ 3 , followed by oncologic diseases (gastric, colonic, pancreatic and liver neoplasms) 31.3%, IBD 20.2%, pancreatic diseases

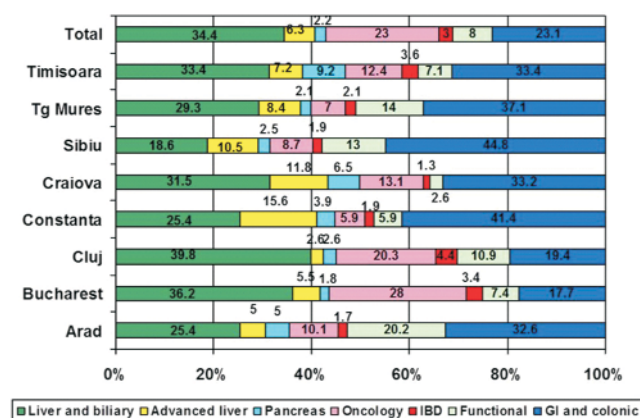


Figure 2. Frequency of various diagnostic classes in different gastroenterology centers

18.9%, other organic gastrointestinal and colonic diseases 10%, functional gastrointestinal disorders 9.3% and other hepato-biliary diseases (liver cirrhosis Child-Pugh class A, viral/ autoimmune hepatitis, steatohepatitis, Wilson disease, biliary lithiasis/disorders) 8.1%.

Overall, the prevalence of malnutrition, irrespective of severity was 25.2%, being of 9.3% when defined only by using $>10\%$ unintentional weight loss, and 20.4% when defined only by using BMI assessment ($<20 \text{ kg/m}^2$). There was a statistically significant difference ($p < 0.0001$) in malnutrition prevalence between centers, irrespective of the criteria used to define it (Table 2). The highest prevalence of BMI $< 20 \text{ kg/m}^2$ was encountered in patients with advanced liver disease (39.4%), followed by patients with IBD (30.6%), malignant diseases (26.8%), pancreatic diseases (23%), functional gastro-

Table 1. Patients characteristics according to different gastroenterology centers

Variable	Arad	Bucharest	Cluj	Constanta	Craiova	Sibiu	Targu Mures	Timisoara
Males	57.6%	51.5%	48.7%	39.2%	63.2%	52.8%	53.8%	50.6%
Females	42.4%	48.5%	51.3%	60.8%	36.8%	47.2%	46.2%	49.4%
Age (years)	54.5 ± 13.8	53.9 ± 14.1	56 ± 16.8	56.3 ± 15.1	53.6 ± 15.0	56.3 ± 14.5	58.1 ± 13.9	55.7 ± 14.8
Height (m)	1.65 ± 0.23	1.66 ± 0.17	1.66 ± 0.08	1.65 ± 0.09	1.52 ± 0.49	1.54 ± 0.42	1.65 ± 0.21	1.61 ± 0.3
Weight (kg)	72 ± 18.2	68.8 ± 14.8	60.3 ± 13.1	66.2 ± 18.8	69.7 ± 13.5	69.1 ± 14.7	68.7 ± 13.4	70 ± 34.8
BMI (kg/m^2)	25.4 ± 5.41	24.4 ± 4.8	21.7 ± 4.3	23.5 ± 6.4	21 ± 12	25 ± 4.5	24.4 ± 4.3	23.9 ± 14.2

Table 2. Prevalence of malnutrition in different gastroenterology centers

Variable	Arad	Bucharest	Cluj	Constanta	Craiova	Sibiu	Targu Mures	Timisoara
BMI $< 20 \text{ kg/m}^2$	22%	20.2%	47.8%	30.8%	11.8%	11.7%	20.3%	17.8%
BMI $> 20 \text{ kg/m}^2$	78%	79.8%	52.2%	69.2%	88.2%	88.3%	79.7%	82.2%
$> 10\%$ weight loss	23.7%	7.6%	22.1%	19.2%	6.6%	8%	13.3%	11.6%
$< 10\%$ weight loss	76.3%	92.4%	77.9%	80.8%	93.4%	92%	86.7%	88.4%

intestinal disorders (20.9%), other organic gastrointestinal and colonic diseases (17.6%) and other hepato-biliary diseases (12.8%). For severe malnutrition, BMI $< 16 \text{ kg/m}^2$, the highest prevalence was recorded for IBD patients (5.1%), followed by advanced liver disease (4.4%), pancreatic diseases (2.7%), other organic gastrointestinal and colonic diseases (2.3%), malignant diseases (1.9%), functional gastrointestinal disorders (1.2%) and other hepato-biliary diseases (0.4%). Among patients with IBD the prevalence of malnutrition was no different between Crohn's disease and ulcerative colitis patients, while the frequency of severe malnutrition was higher in Crohn's disease patients, without reaching statistical significance. BMI value showed a moderate negative correlation with NRS value ($r = -0.47$, $p < 0.0001$) and a weak negative correlation with the weight reduction within the last 3 months ($r = -0.23$, $p < 0.0001$). There was a moderate positive correlation between NRS value and the weight loss/3 months ($r = 0.53$, $p < 0.0001$). Patients with oncologic diseases had a significant lower BMI compared to other patients ($23.3 \pm 4.5 \text{ kg/m}^2$ vs $24.6 \pm 4.9 \text{ kg/m}^2$, $p < 0.0001$). The same was true for patients with advanced liver diseases ($22.4 \pm 4.7 \text{ kg/m}^2$ vs $24.5 \pm 4.8 \text{ kg/m}^2$, $p < 0.0001$) and with IBD ($22.6 \pm 4.3 \text{ kg/m}^2$ vs $24.4 \pm 4.8 \text{ kg/m}^2$, $p = 0.0004$). It can be noted that patients with other hepato-biliary diseases had a significantly higher BMI ($25.4 \pm 4.6 \text{ kg/m}^2$ vs $23.8 \pm 4.9 \text{ kg/m}^2$, $p < 0.0001$), as well as patients with other organic gastrointestinal and colonic diseases had higher BMI ($24.7 \pm 5.3 \text{ kg/m}^2$ vs $24.2 \pm 4.7 \text{ kg/m}^2$, $p = 0.02$) as well. A higher frequency of females had functional GI disorders 10.2% vs 5.3% males, $p < 0.0001$. Among functional disorders, patients with low BMI $< 20 \text{ kg/m}^2$ were in a higher proportion of female gender (12.3% vs 2.9% males).

Risk factors for malnutrition in gastroenterology setting

In the univariate analysis, malnutrition (BMI $< 20.5 \text{ kg/m}^2$) was associated with female gender (22.7% vs 18.3%, $p = 0.001$), younger age (52 ± 17.5 vs 55.2 ± 13.4 years, $p < 0.0001$), oncologic diseases (26.8% vs 18.6%, $p < 0.0001$), advanced liver cirrhosis (39.4% vs 19.2%, $p < 0.0001$), presence of IBD (30.6% vs 20.1%, $p = 0.01$), higher NRS value (2.5 ± 0.04 vs 0.8 ± 0.01 , $p < 0.0001$), reduction of $> 25\%$ of dietary intake (33.7% vs 13.6%, $p < 0.0001$), higher weight loss / 3 months (6.2 ± 0.83 vs 2.0 ± 0.08 , $p < 0.0001$). Multivariate analysis including all factors associated with the development of malnutrition identified the following independent factors: younger age ($p < 0.0001$), female gender ($p < 0.0001$), a higher NRS ($p < 0.0001$), oncologic ($p < 0.0001$) and advanced liver diseases ($p = 0.0003$) and a reduction of $> 25\%$ of dietary intake ($p < 0.0001$).

The following risk factors were identified for severely malnourished patients: presence of IBD (5.1% vs 1.7%, $p = 0.01$), NRS ≥ 3 (8.2% vs 0.5%, $p < 0.0001$), higher weight loss / 3 months (19.7 ± 9.5 vs 2.6 ± 0.09 , $p < 0.0001$), reduction of $\geq 50\%$ of dietary intake (9.4% vs 1.1%, $p < 0.0001$). Presence of IBD ($p = 0.008$), NRS ≥ 3 ($p < 0.0001$) and a reduction of $\geq 50\%$ of dietary intake ($p = 0.001$) were independent risk factors for a BMI $< 16 \text{ kg/m}^2$.

Discussion

Malnutrition is present in a highly variable percentage (between 20-80%) of patients admitted to hospitals. Malnutrition prevalence depends on the type of disease, being different between medical and surgical wards (11). Another determinant factor is the patient's country of origin, although significant differences between northern and southern regions of the same country have been described (2). While general prevalence of malnutrition is frequently reported for patients admitted to hospitals, specific characterization of patients with gastrointestinal, liver or pancreatic diseases admitted to gastroenterology units are scarce. The causes of malnutrition are usually multifactorial including metabolic effects of the underlying disease, dietary restriction, and reduced nutritional intake. Additional factors such as age, medications, educational level and socio-economic situation might increase the general risk of developing nutritional deficits (12). Due to specific symptoms (anorexia, nausea, vomiting, diarrhea, and abdominal pain) diseases involving the digestive tract, liver and pancreas are expected to have a significant impact on the patient's nutritional status.

The aim of our study was to report for the first time the nutritional risk and the prevalence of malnutrition in patients admitted to Gastroenterology departments in Romania. Our study involved 8 gastroenterology units, all referral centers admitting patients from the main regions of the country. Almost 3200 patients were evaluated.

In all patients the nutritional risk score (NRS 2002) was assessed in the first day, at admission. NRS 2002 identifies those patients that will most likely benefit from nutritional interventions, correlates well with subjective global assessment and is recommended by ESPEN for the nutritional screening of hospitalized patients (13,14). It was shown that patients classified as being "at risk" by NRS 2002, had more complications, increased length of stay in hospital and also higher mortality (15). Overall, 17.1% of patients evaluated in our study were considered to be at nutritional risk. This relatively low figure was due to the presence among admitted patients of those with functional disorders (dyspepsia, irritable bowel disease) and benign organic gastrointestinal diseases such as: colonic polyps, diverticulosis, gastritis, gastric or duodenal ulcer, in which the assessed nutritional risk was low (8-10%). While the overall risk was low, for certain groups of patients a particularly increased risk was demonstrated. The highest nutritional risk was observed in patients with liver diseases (almost half of these patients being at risk according to NRS 2002). Not unexpectedly, another category with an elevated nutritional risk was that of patients with gastrointestinal neoplastic diseases (31.3%). The same high nutritional risk evaluated by NRS 2002 among oncologic patients was reported previously in over 1400 cases but in outpatient setting (16). In the centers that participated in our study there were no outpatient clinics so for specific diagnostic or therapeutic procedures all oncologic cases were admitted as inpatients. Evaluation of nutritional risk in cancer patients is

particularly important due to potential need for surgical intervention in these patients. It was shown that a preoperative NRS score above or equal to 3 is associated with higher post-operative complications and prolonged length of stay in patients with gastric cancer that underwent surgical intervention (17). According to NRS 2002 evaluation, one in five patients admitted in the gastroenterology centers participating in our study with the diagnosis of inflammatory bowel diseases was considered at nutritional risk. Also pancreatic disorders were associated with an increased nutritional risk for 18.9% of admitted patients.

Overall prevalence of malnutrition defined by BMI in our study was of 20.4%, so according to our results one in five patients admitted to gastroenterology departments is malnourished. This is a high figure but it is lower than previous reports regarding patients with gastrointestinal disease: 37.3% in a study from the Netherlands (18). This difference is probably due to the different spectrum of admitted patients. Due to the organization of the health care system in Romania patients with functional diseases, colonic adenomatous polyps or chronic liver diseases including steatohepatitis are also admitted in hospitals and not evaluated in an ambulatory setting as in other countries. The prevalence of malnutrition was very variable among different diseases. The highest prevalence of malnutrition in our study was seen in patients with liver diseases, reaching 39.4% in advanced liver disease. Reduced food intake, sometimes as a result of the so called "liver-diets" poor in fat and protein, along with maldigestion and malabsorption, or repeated paracentesis could explain the impaired nutritional status in liver disease patients. Malnutrition is now considered the most prevalent complication of liver disease (19). The most important risk factor for malnutrition in patients with liver disease in our study was Child Pugh class, the more advanced the liver insufficiency, the more frequent malnutrition was diagnosed. The second most frequent cause for low BMI in patients admitted to gastroenterology clinics was the diagnosis of inflammatory bowel disease (30.6%). Malnutrition was seen equally in patients with Crohn's disease as compared with ulcerative colitis. Severe malnutrition (BMI < 16 kg/m²) was seen with the highest prevalence in IBD patients (5.1%), even more frequent than in liver disease patients (4.4%). Among patients with IBD, a trend towards a higher frequency for severe malnutrition was observed in Crohn's disease without reaching statistical significance. As expected, malnutrition was common among patients with digestive neoplasms (26.8% of cases), severe malnutrition being recorded in 1.9%. For patients with malignancies early diagnosis and correction of malnutrition is very important since many of them will be referred to surgical departments for treatment. Weight loss was proven to be a risk factor for the occurrence of anastomotic leakage in patients with colorectal resections for cancer (20). Our results show that patients with oncologic, advanced liver diseases and IBD had statistically significant lower BMI compared with patients with other digestive diseases admitted in gastro-enterology centers. In pancreatic disease patients malnutrition was also frequently encountered (23% of patients,

with 2.7% severe malnourished cases). Unexpectedly, a high prevalence figure for malnutrition was found in patients with functional digestive disorders (20.9%) our results suggesting that this was due to the high number of young female patients with low BMI admitted with functional dyspepsia or irritable bowel. In patients with gastrointestinal disorders our study identified the following risk factors for the presence of malnutrition: younger age, female gender, over 25% reduction of dietary intake, diagnosis of digestive neoplasm or advanced liver disease. A high NRS 2002 score was also significantly associated with the presence of malnutrition, the values over or equal to 3 being associated with severe malnutrition (BMI < 16). The diagnosis of IBD and reduction of dietary intake with more than 50% were significantly associated with severe malnutrition. In conclusion, an important proportion of patients admitted to gastroenterological centers in Romania are at nutritional risk, one in five patients could benefit from prompt nutritional intervention. Our study identified three categories of patients which have not only a high risk for malnutrition but also a high prevalence of malnutrition: patients with advanced liver disease, inflammatory bowel disease, digestive neoplasms and pancreatic diseases. Special emphasis on nutritional evaluation at admission is particularly required in these groups of patients. The results of our study demonstrate that nutrition is a significant part of gastroenterology practice with tremendous impact on disease outcome, and for this reasons, every gastroenterologist should incorporate nutritional assessment and disease-specific nutritional management into his/her day-to-day clinical practice.

Statement of authorship

Author contributions to the manuscript were as follows: CG designed the study, coordinated and drafted the manuscript. RI and SI carried out the data analysis, performed the statistical analysis and helped draft the manuscript. RV helped draft the manuscript and in the collection of data.

LG participated in interpretation of data, writing and revising the manuscript. OP, AG, MT, ED, DD, EM, AS, and AF participated in the collection of data.

Conflict of interest statement

There was no conflict of interest from the authors related to this paper.

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