Title: A multicentre study of nutrition risk assessment in adult patients with inflammatory bowel disease attending outpatient clinics

Short title: Nutrition risk in adult IBD outpatients

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Authors' contribution

ML, KG, DG, GJM conceived and developed the study

OC, AB, PPS, KK and CD collected the data

ML and KG performed the statistical analysis

ML and KG drafted the manuscript

All authors critically reviewed the manuscript and approved its final version

Abstract

Background

Overnutrition and undernutrition can affect patients with inflammatory bowel disease (IBD). Although all IBD outpatients should be screened for nutrition risk, screening is not routinely performed, potentially leading to reduced identification and treatment. This study aimed to estimate the prevalence of nutrition risk in adult IBD outpatients and the proportion of cases who discussed diet and/or nutrition during their routine clinical appointment.

Methods

Adults with IBD attending outpatient clinics at four hospitals in Greece and in UK were recruited. Demographic and anthropometric data were collected using face-to-face patient interviews and clinical records. Patients were classified as high (i.e. BMI <18.5kg/m^2 or 18.5-20kg/m^2 and weight loss >5%), moderate (i.e. BMI 20-25 kg/m^2 and weight loss >5%) or low risk of undernutrition and high risk of obesity (i.e. BMI 25-30% and weight gain >5%). The proportion of patients who discussed diet and/or nutrition during their clinical appointment was calculated.

Results

In total, 390 IBD patients participated. Sixteen (4%) patients were underweight, 113 (29%) were overweight and 71 (18%) were obese. Twenty-one (5%) patients were at high risk of undernutrition; of these four (19%) were under dietetic care. Of those at high risk of undernutrition, 11 (52%) had discussed diet and/or nutrition during their routine clinical appointment. Fifty-six (14%) patients had gained more than 5% weight since their last recorded/reported weight and 19 (5%) were at high risk of obesity.

Conclusions

Few patients were identified to be at high risk of undernutrition and less than a fifth of these were under dietetic care. Overnutrition is a growing problem in IBD with almost half of adult patients being overweight or obese. Diet and/or nutrition were not routinely discussed in this group of IBD outpatients.

Introduction

In inflammatory bowel disease (IBD), undernutrition may be caused by reduced oral intake, increased gastrointestinal losses, raised nutrient requirements and occasionally, drug-nutrient interactions [1]. Patients with active Crohn's disease (CD) are at greatest risk of undernutrition, particularly the newly diagnosed [1,2].

Historically, IBD has been associated with undernutrition, however, in recent years, better disease management and the obesity epidemic may have increased the risk of overnutrition. Thus, between 15-40% of IBD patients are now reported as overweight or obese [3,4]. Nutrition screening of all inpatients is mandatory and routinely carried out in the health services of certain countries. Such process identifies patients with or at risk of undernutrition who will subsequently be referred for comprehensive dietetic assessment [5-7]. There are few reports of nutrition screening in the IBD outpatient setting [8].

Beyond the pharmacological management of active disease, nutrition and diet are important aspects in the treatment of patients with IBD. However, these are barely discussed between clinicians and patients in routine IBD practice [9] and despite the fact that three out of the 10 current priorities for all research in IBD are pertinent to diet [10,11].

The aims of this study were to determine (i) the prevalence of undernutrition and/or overnutrition in adult IBD outpatient clinics, (ii) the proportion of patients who discussed with their clinician aspects around diet or nutrition, during their recent appointment and (iii) the dietetic referral rate for patients identified as at risk of malnutrition by nutrition screening.

Methods

All consecutive patients with CD, ulcerative colitis (UC) or IBD unclassified (IBDU) who attended adult outpatient clinics at four hospitals in Greece and UK (Glasgow Royal Infirmary, Glasgow, UK; Guy's and Thomas' NHS Foundation Trust, London, UK; Ioannina General Hospital, Ioannina, Greece; Evangelismos-Ophthalmiatreion Athinon-Polykliniki General Hospital, Athens, Greece) over a period of 8 weeks were eligible to take part.

Disease diagnosis was ascertained using the European Crohn's and Colitis Organisation diagnostic criteria, including endoscopy with biopsies[12]. As the majority of patients who attend the clinics above suffer from active symptoms or require treatment at hospital (e.g. for infusion for biologics) this study was likely to recruit patients with more complicated disease. For all centres included in this study, routine screening for disease associated malnutrition was not compulsory in the outpatient setting.

Patients were identified by a member of the clinical team and introduced to the researcher. Selection of patients was based on convenience sampling and in a consecutive, unselected manner. The researcher verbally introduced the study to the participants and asked if they would be willing to answer 5 questions and have their weight and height measured. Information on demographics, disease characteristics, medical and nutritional treatment were collected from clinical notes and if not available by face-to-face interview with patients. Current disease activity was reported by patients, following their clinical appointment, as active or in remission. Previous measurements of weight were recorded from the clinical notes or were reported by patients. Patients were also asked to report a decline in usual intake and weight loss over the past week. Likewise, the number of patients who reported any diet and/or nutrition discussion during their clinician appointment was recorded (e.g. diet, weight loss or appetite).

Weight (to the nearest 0.1 kg) and height (to the nearest 0.1cm) were measured using standard operating procedures. Using the World Health Organisation criteria for body mass index (BMI), underweight was defined as <18.5kg/m^2, normal BMI as 18.5-24.9kg/m^2, overweight as 25-29.9kg/m^2 and obesity as > 30kg/m^2. To define high risk of undernutrition, we used the first two steps of the Malnutrition Universal Screening Tool (MUST), a tool widely used in Europe and endorsed for use in the UK, as the third one is more appropriate for inpatients [13]. Therefore, patients with BMI <18.5kg/m^2 or 18.5-20kg/m^2 and at least 5% concomitant weight loss between current and previous recorded/reported weight were classified as high risk of undernutrition as per MUST scoring. This nutrition risk benchmark we chose is also in accordance to the consensus statement for the diagnostic criteria of malnutrition endorsed by the European Society for Clinical Nutrition and Metabolism [14].

Patients with BMI 20-25 kg/m^2 and at least 5% weight loss were classified as moderate risk of undernutrition. Similarly, overweight patients with at least 5% weight gain were classified as high risk of obesity.

Ethical permission was waived for this study as this was an evaluation of current practice at each centre[15].

Statistical analysis

Data are presented with descriptive statistics with differences between groups reported using two sample t-test for continuous data (mean (SD)) and chi-squared test for categorical data (n (%)). Logistic regression analysis was used to associate risk of malnutrition or obesity with demographics and disease characteristics. MINITAB 17 and SPSS 24 were used for statistical analysis. Assuming an estimate of 20% of patients classified at high risk of undernutrition, with 5% precision and 95% CI, the required sample size is 246 participants.

Results

In total, 390 patients (CD=247 (63%), UC=127 (33%), IBDU=16 (4%)) were recruited from the four centres with 175 (55%) reporting active disease (Table 1). Sixteen (4%) patients were underweight, 190 (49%) were normal weight, 113 (29%) were overweight and 71 (18%) were obese (Figure 1). Forty-six (12%) patients reported having a reduced intake and 80 (21%) patients self-reported weight loss. Twenty-seven (7%) patients were under the care of the dietitian.

Routine evaluation of nutritional and dietary aspects

Aspects around diet and/or nutrition were discussed in 135 (35%) patients during their clinician appointment. Eighty-nine (23%) patients conveyed a discussion about diet, 91 (23%) about weight loss and 82 (21%) about their appetite during their recent appointment. Two hundred and fifty-five (65%) patients did not discuss any of these aspects. The extent of weight loss was significantly higher in patients who had discussed with their clinician aspects around diet [discussed: -1.15 kg (6.0) *versus* not discussed: 0.65 (6.2); p=0.016], weight loss

[discussed: -1.65 kg (6.6) *versus* not discussed: 0.81 kg (6.0); p=0.002], or appetite [discussed: -1.62 kg (6.1) *versus* not discussed: 0.73 kg (6.2); p=0.002].

Risk of undernutrition

In total, 21 (5%) patients were at high risk of undernutrition (Figure 1). Of those, only 4 (19%) were under dietetic care and 11 (52%) discussed diet and/or nutrition in their clinician appointment. Twenty-six (7%) patients were screened at moderate risk of undernutrition. Of those, only 3 (11%) were under dietetic care and 11 (41%) had a discussion about diet and/or nutrition in their clinician appointment.

Compared to the patients at low risk of undernutrition, the 47 (12%) patients at moderate or high risk (combined) were more likely to have a discussion with their clinician about diet [moderate/high risk: 17 (35%) *versus* low risk: 72 (21%); p=0.049], weight loss [moderate/high risk: 22 (46%) *versus* low risk: 69 (20%); p<0.001], or appetite [moderate/high risk: 16 (33%) *versus* low risk: 66 (19%); p=0.050]. The odds ratio for clinician appointment discussion about weight loss increased (p=0.002) according to their level of undernutrition risk [OR (95% CI): high risk, 3.6 (1.4 to 8.7); moderate risk 3.1 (1.3 to 7.1)]. Patients at moderate/high risk of undernutrition were younger [moderate/high risk: 36.2 years (13.9) *versus* low risk: 41.0 years (14.9); p=0.032] and had a shorter disease duration [moderate/high risk: 7.1 years (9.7) *versus* low risk: 10.8 years (9.7); p=0.012]. Patients at moderate/high risk of undernutrition were more likely than those at low risk to have active disease [moderate/high risk: 34 (71%) *versus* low risk: 14 (29%); p<0.001]. Neither BMI (r=0.04, p=0.432) nor recent weight loss (r=-0.02, p=0.728) were associated with disease duration. There was no difference in the prevalence of high undernutrition risk between patients with CD and UC (p=0.809).

Overweight, obesity and risk of obesity

Fifty six (14%) patients had gained more than 5% weight since their last recorded/reported weight. Apart from the 71 (18%) of the patients who were obese, 19 patients (5%) were at high risk of obesity. There was no association between obesity or risk of obesity and discussion during the clinician appointment about diet, weight loss or appetite. There was a

weak positive association between BMI and weight gain (r=0.15, p=0.003) and patients who were either obese or at risk of obesity were older [obese/obesity risk: 43.8 years (14.2) versus low risk: 39.4 years (14.9); p=0.013]. Disease activity was not associated with obesity or risk of obesity. Obesity and risk of obesity did not differ by country (p=0.624) or by IBD subtype (p=0.237).

There were no major differences for other nutritional outcomes between centres and as the number of patients at high nutrition risk was small, no statistical analysis by centre was performed.

Discussion

This study in four hospitals from two European countries identified that only 5 and 7% of IBD outpatients were at high and moderate risk of undernutrition, respectively. This figure is lower than the 27-30% of IBD patients reported at high risk of undernutrition in the literature [8,16]. The low prevalence of risk of malnutrition observed in the current study is likely to be attributed to the enrolment of patients with longstanding disease, in whom undernutrition is less common than in newly diagnosed and treatment naïve patients, the better disease management nowadays and may be a reflection of the obesity epidemic in the general population. In a pooled analysis of 1698 population-based measurement studies with 19.2 million participants in 200 countries, trends of obesity increased markedly from 1975 to 2014 with approximately 25% of the general Greek and UK population classed as obese [17]. In previous research in CD children, the prevalence of undernutrition dropped from 35% at diagnosis to 2% at 24-month follow-up and obesity concomitantly increased [18]. It is also unlikely that our findings are explained by having oversampled patients in remission or with less complicated disease as we enrolled patients attending outpatient clinics due to ongoing disease symptoms or biologic infusion clinics, as indicated by the characteristics of our sample (Table 1).

Another important finding of this study is that two-thirds of patients did not discuss diet and/or nutrition during their clinician appointment which further supports the argument that this aspect of patient care receives less attention than the management of active disease [19]. Although a small number of patients were at high risk of undernutrition, still in

almost half of them (43%) diet and/or nutrition were not discussed, thus risk was not identified nor the appropriate care pathway implemented.

Only 4 (19%) high risk patients were receiving dietetic care, consistent with the findings of previous research showing that only 15% to 17% of malnourished outpatients receive nutritional treatment [20,21]. This is of concern given that advice on diet is one of the most important issues for patients with IBD [10,11,22] and previous authors reported that of those who had not seen a dietitian, the vast majority would have liked to [23].

It is therefore necessary that appropriate action be taken to help increase the frequency of nutritional screening in IBD outpatients. One action to overcome barriers with nutritional screening would be to program the calculation of BMI, percent weight loss and nutritional risk score into IT systems or allowing patients to input this data remotely supporting self-management; thereby reducing the amount of time the process takes. Patients could be given the option to screen at home as an alternative to screening during clinical visits [8,24], which would serve not only to reduce the burden on healthcare staff but also empower patients to be more involved in their own care [25]. However such a process would require availability of dietetic resources to formally review high risk cases.

A drawback of this study is that BMI has limited use to reflect body composition which might be a better marker to evaluate the risk of undernutrition and overnutrition in IBD. This is particularly important as patients with IBD and undernutrition are more likely to present higher levels of adiposity, for the same unit of BMI as healthy controls, are more prone to cardiovascular diseases [26,27] and undernutrition can affect adversely their quality of life and clinical outcomes [28]. In this study, percentage weight loss was determined using the current and last recorded weight. Where the last recorded weight was unavailable, patients were asked to self-report but this is often normal in routine clinical practice and incorporated into nutrition screening tools, e.g. MUST [13,29]. Likewise, the timeframe within changes in weight were assessed was not specified and it was therefore variable. However, both our definition of risk of obesity and undernutrition included patients who were already overweight or slightly underweight, based on BMI measurements alone. Information on participants' co-morbidities and other concomitant gastrointestinal diseases was not collected but these are unlikely to have influenced the main findings of this study. As this

was an appraisal of current clinical practice, dietary assessment was not performed and body composition measurements could not be obtained to describe the eating habits of our population and the proportion of patients suffering from sarcopenia, obesity or myopenia.

In conclusion, only 4 in every 100 IBD patients were underweight, while almost half were either overweight or obese. Obesity in IBD has been associated with poor disease outcomes and patients with IBD are at increased risk of cardiovascular disease [4,27]. Therefore, provision of weight loss interventions as an adjunctive therapy in these individuals is an area that requires further research.

Conflicts of interest

KK reports consultation and speaker fees from Abbvie, MSD, Takeda, Shire and Janssen

DG has received speaker fees and travels grants from MSD, Abbvie, Vifor, Takeda and Janssen

KG reports personal fees from Nutricia, research grants and personal fees from Nestle, personal fees from DrFalk, research grants from Mead Johnson Nutrition

MCL is a co-inventor of a mobile app regarding the low FODMAP diet and has received lecture fees from Janssen, Nutricia, Yakult and Takeda

GJM has served as advisory board member for AbbVie, Astellas, Celgene, Danone, Ferring, Genesis, Hospira, Janssen, Millennium Pharmaceuticals, MSD, Otsuka, Pharmacosmos, Pfizer, Sandoz, Takeda, UCB; as speaker for AbbVie, Angelini, Astellas, Danone, Falk Pharma, Ferring, Galenica, Hospira, Janssen, MSD, Omega Pharma, Takeda; as consultant for MSD and Takeda and received research support from AbbVie, Galenica, Genesis, Menarini Group, MSD and Pharmathen.

DC has received speakers fees and acted as consultant for MSD, Abbvie, Takeda, Enorasis, Ferring, Shire, Janssen.

The rest of the authors have no conflicts of interest to disclose.

Figure legends

Figure 1: Body mass index and nutrition risk classification

Athens Glasgow Ioannina London

(a) Body mass index (BMI) is classified as underweight <18.5kg/m^2, normal 18.5-24.99kg/m^2, overweight 25-29.99kg/m^2, obese >30kg/m^2.

(b) High obesity risk was for patients who were at high risk of obesity and had a BMI>25 and at least 5% concomitant weight gain between current and previous recorded/reported weight. High risk was for patients at high risk of undernutrition and had a BMI <18.5kg/m^2 or 18.5-20kg/m^2 and at least 5% concomitant weight loss between current and previous recorded/reported weight. Moderate risk was for patients at moderate risk of undernutrition and had a BMI 20-25 kg/m^2 and at least 5% concomitant weight loss between current and previous recorded/reported weight. Low risk was for patients at low risk of undernutrition or obesity not in any of the above categories.

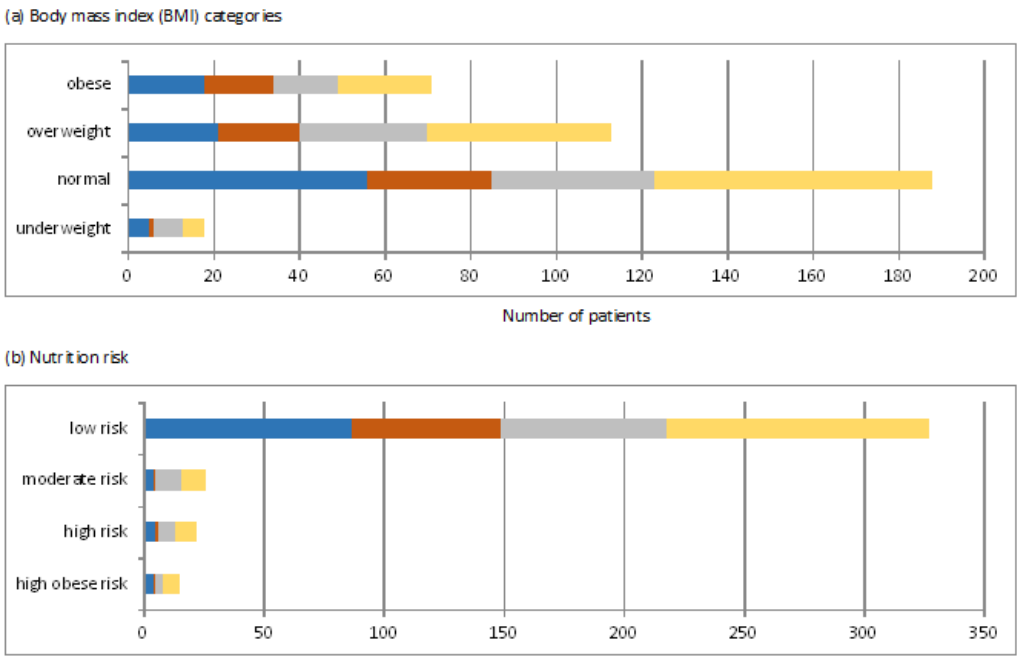

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Table 1: Participants characteristics

	Athens	**Glasgow**	**Ioannina**	**London**	**Total**
	100	65	90	135	390
Mean (SD)					
Age, y	39.1 (13.1)	44.1 (17.6)	43.6 (15.7)	37.5 (13.2)	10.5 (9.5)
Weight, kg	73.5 (15.2)	74.1 (15.2)	74.3 (16.6)	74.4 (16.6)	74.1 (16.0)
Height, cm	170 (9.9)	169 (10)	171 (10)	170 (10)	170 (10)
BMI, kg/m^2	25.3 (4.6)	26.2 (5.2)	25.3 (4.5)	25.6 (5.0)	25.6 (4.8)
Disease duration, y	10.7 (8.2)	11.1 (10.1)	9.0 (11.3)	10.9 (11.3)	10.5 (9.5)
N (%)					
Gender					
Males	50 (50)	28 (43)	53 (59)	72 (53)	203 (52)
Females	50 (50)	37 (57)	37 (41)	63 (47)	187 (48)
Disease*					
UC	32 (32)	13 (20)	32 (32)	44 (32)	127 (33)
CD	66 (67)	47 (72)	66 (67)	82 (61)	247 (63)
IBDU	1 (1)	5 (8)	1 (1)	9 (7)	16 (4)
Disease activity*					
Remission	64 (64)	32 (49)	58 (64)	61 (45)	215 (55)
Active	36 (36)	33 (51)	32 (36)	74 (55)	175 (45)
Medication					
Azathioprine*	24 (24)	33 (51)	41 (30)	41 (30)	139 (36)
5-ASAs*	52 (52)	31 (48)	2 (2)	44 (33)	129 (33)
Biologics*	30 (30)	20 (31)	57 (63)	42 (31)	149 (38)
Oral steroids	12 (12)	9 (14)	6 (7)	17 (13)	44 (11)
Vitamins/minerals*	24 (24)	15 (23)	5 (6)	71 (53)	115 (29)
Nutritional supplements	3 (3)	2 (3)	0 (0)	7 (5)	12 (3)

***** $p<0.05$ between centres