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MALNUTRITION RISK SCREENIG, ASSESSMENT AND ACTIVE DISEASE AMONG PATIENTS WITH INFLAMMATORY BOWEL DISEASE: A HOSPITAL-BASED PROSPECTIVE CROSS-SECTIONAL STUDY

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ACRONYMS and ABBREVIATIONS

AZA Azathioprine

BMI Body mass index

BUN Blood urea nitrogen

CBC Complete blood count

CD Crohn's disease

CDAI Crohn's disease activity index

CRP C- reactive protein

ESR Erythrocyte sedimentation rate

HBI Harvey Bradshow Index

IBD Inflammatory bowel disease

IFX Infliximab

MRI Magnetic resonance imaging

MTX Methotrexate

MUAC Mid upper arm circumference

MUST Malnutrition screening tool

SGA Subjective global assessment

TASH Tikur Anbesa Specialized Hospital

UC Ulcerative colitis

WBC White blood cell count

ETB Ethiopian Birr

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ABSTRACT

Background: Inflammatory bowel disease (IBD) is a chronic inflammatory disease of the gastrointestinal tract and is divided into Crohn's disease and ulcerative colitis rarely indeterminate or un classified. Malnutrition is prevalent among IBD patients and is associated with risks of poor outcomes. Hence early detection of patients with or at risk of under nutrition facilitates timely referral for comprehensive dietary assessments and management to avert related complications.

Objectives: To assess the nutritional status and IBD disease activity among patients with inflammatory bowel disease in Tikur Anbessa Specialized Hospital and Adera Medical and Surgical Center, Ethiopia, 2024.

Methods: A total of 252 patients with inflammatory bowel disease (IBD) were selected using consecutive recruitment technique. Data was collected from the medical records of patients and by interviewing the study participants using a structured questionnaire. Bivariate logistic regression was employed followed by multivariable analysis to look at the association between the outcome and predictors by selecting variables that had a p-value less than or equal to 0.25 within the bivariate analysis. P value <0.05 was used to declare significance.

Result: Total of 242 individual were participated with response rate of 96.03%. Majority of the IBD were Crohn's disease 190(78.51%) and the rest 52 (21.49%) were ulcerative colitis. A 160(66.12%) of the patient had no clinical features of active disease (in remission) and the rest were had active disease at inclusion 82(33.88%). IBD patients with monthly income between 500-1000 ETB were about 80% decrease risk of active disease at inclusion compared to income less than 500 ETB AOR (0.20; 95% CI (0.05,0.81). Patients with medium risk for malnutrition based on MUST score is about 2 times increased risk for active disease compared to those at to low risk AOR (2.55 ;95 % CI (1.01,6.42) and those with high risk were about 4 times at increased risk compared to low risk for malnutrition AOR (4.25CI (1.66,10.84).

Conclusion: Malnutrition is prevalent among this cohort of IBD patients. one third of Inflammatory bowel disease patients in this study have clinical features of active diseases at inclusion. Malnutrition, Income level, elevated inflammatory factor, MUST score and locations of disease are found to be significant predictors of clinical disease activity at inclusion. These

findings emphasize the importance of targeted interventions to address nutritional, clinical and socioeconomic determinants of IBD outcomes.

Keywords: Inflammatory bowel disease, nutritional screening tools, nutrition, Ethiopia.

1. INTRODUCTION

1.1 Background

Inflammatory bowel disease (IBD) is a chronic inflammatory disease of the gastrointestinal tract and is divided into Crohn disease, ulcerative colitis and indeterminate colitis(1). Inflammatory bowel diseases (IBD) are characterized by chronic inflammation of the intestinal mucosa resulting from strong interaction between genetic, environmental, immunologic and intestinal microbial factors(2).The term 'IBD' is most often used to describe two separate conditions: ulcerative colitis (UC) and Crohn's disease (CD)(3). Available evidence suggests that the incidence of IBD is increasing globally in general and in Africa particularly(4–6). Switch from an agriculture based lifestyle towards an industrial and post-industrial mode and changing fibres based diets for industrial fast food are believed to be among the environmental factors contributing to the increasing burden of IBD worldwide(7).

The prevalence of malnutrition in inflammatory bowel diseases (IBD) is estimated to be between 6.1% and 69.7% depending on the definition used, the type of IBD, the clinical setting and disease activity(8).Due to its high prevalence and associated risks, early detection of IBD patients at risk of developing malnutrition of high importance(8). Malnutrition in IBD is a result of a complex interplay of multiple factors (Figure 1 below)(9).

Malnutrition in patients with Inflammatory Bowel Disease (IBD) arises from several interrelated factors that affect their nutritional status and overall health(10,11). Chronic inflammation is a primary contributor, as it increases metabolic demands and can impair nutrient absorption in the intestines, leading to deficiencies of essential vitamins and minerals(12). Dietary restrictions often adopted by patients—whether to manage symptoms or reduce inflammation—can limit the intake of vital nutrients, exacerbating the risk of malnutrition(13).

Moreover, gastrointestinal symptoms such as diarrhoea, nausea, vomiting, and abdominal pain can significantly hinder adequate food intake and nutrient utilization, further compounding the risk of under nutrition(14). Psychosocial factors, including anxiety and depression, are prevalent among those living with chronic illness and can negatively affect appetite and motivation to eat a balanced diet(13). In addition, socioeconomic factors, such as food insecurity and limited access to healthcare resources, can restrict patients' ability to maintain a nutritious diet. Lastly,

medication side effects from treatments like corticosteroids can alter metabolism and appetite, complicating nutritional management(13,15). Understanding these multifaceted causes is crucial for developing effective interventions to improve the nutritional status and overall health of IBD patients, ultimately enhancing their quality of life(13).

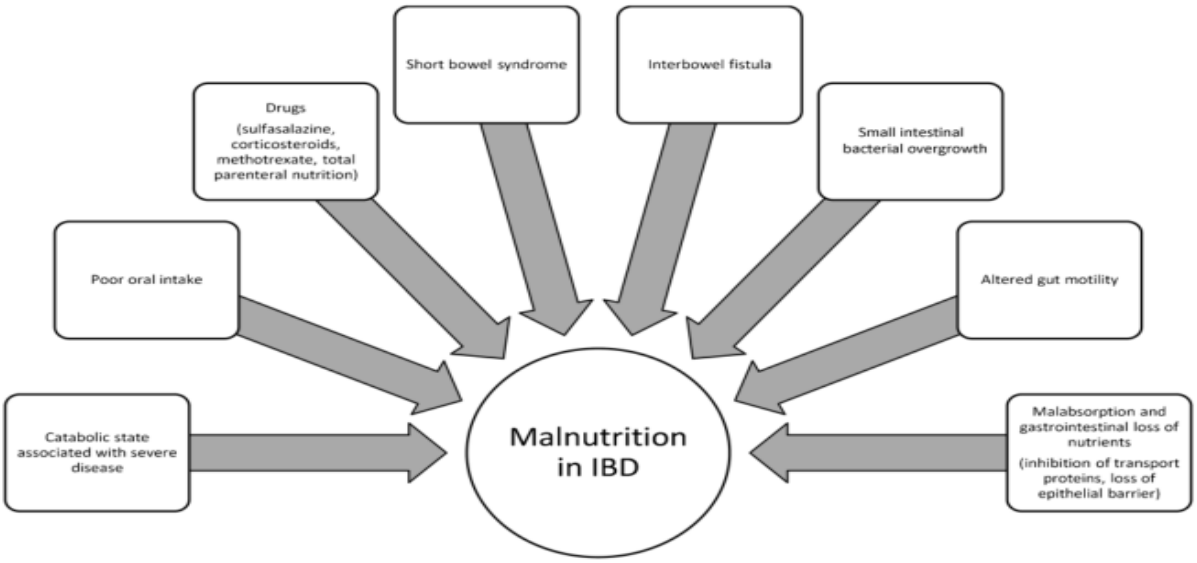

Figure 1. Determinants of malnutrition in inflammatory bowel disease (IBD)(9).

1.2 Statement problem

The intricate interplay between the chronic inflammatory nature of IBD, and the potential effect of IBD on nutrient absorption nutritional absorption raises concerns about the potential nutritional risk faced by these patients(16).

Nutrition screening identifies patients with or at risk of under nutrition who will subsequently be referred for comprehensive dietetic assessment(17). Despite advancements in medical interventions and therapeutic strategies for managing IBD, the impact of nutritional status on the clinical outcomes of patients' remains inadequately understood(18).

Globally, studies have shown that malnutrition and poor nutritional status correlate with higher disease activity, leading to more frequent hospitalizations and surgical interventions(19). In high-income countries, routine nutritional screening is implemented, enabling healthcare providers to identify at-risk patients and tailor interventions that mitigate complications(20). For instance, in

the United States and Europe, early medical nutrition therapy has been associated with improved quality of life and reduced healthcare costs related to IBD management.

Evaluation of nutritional status at admission, particularly in active disease is essential because early medical nutrition therapy can decrease disease morbidity and improve quality of life(18). However, in many African countries, including Ethiopia, such systematic approaches to nutritional screening are lacking, leading to delayed interventions and worsened health outcomes

This study is conducted to assess the risks of malnutrition and nutritional status of IBD patients as well as correlation of under nutrition with clinical outcome including IBD disease activity, rates of hospitalization and surgery among IBD patients attending care at two health institutions in Addis Ababa, Ethiopia during the period

1.3 Significance of the study

There is no adequate data on the risks and prevalence of malnutrition and its correlation with clinical outcomes among IBD patients in Ethiopia. This study assessed the risk of malnutrition, proportion of patients with malnutrition and active IBD at inclusion to study and the rates of hospitalization and surgery. The information obtained adds important locally applicable knowledge and improves awareness on the relevance of nutritional evaluation and its impact on patient outcomes in clinical practice in our country and similar low-income settings.

2. LITERATURE REVIEW

2.1 Introduction

The literature review was organized into three themes: the definition and magnitude of inflammatory bowel disease, predictors of active disease at inclusion, and the conceptual framework. Relevant publications were identified through thorough searches in databases like PubMed, Google Scholar, and Web of Science, using keywords and abstracts, and citations were managed with Zotero.

2.2 What is inflammatory bowel disease?

Inflammatory bowel disease (IBD) is a chronic inflammatory condition of the gastrointestinal tract, comprising two main subtypes: Crohn's disease (CD) and ulcerative colitis (UC). UC affects only the colon, while CD can impact any part of the GI tract, from the mouth to the perianal area. Despite different clinical and pathological features, these disorders share substantial overlap, and their exact causes remain unclear (21,22).

Crohn's disease is characterized by trans mural inflammation and "skip areas" of normal bowel, leading to fibrosis, strictures, and complications like fistulas (21). The disease course in IBD varies between relapses and remission, making assessment of malnutrition and sarcopenia essential for guiding management and outcomes(23).

Malnutrition is an imbalance in nutrient intake, defined by the WHO as an imbalance in energy or nutrients and by the European Society for Clinical Nutrition and Metabolism as inadequate intake affecting body composition and function(24,25).

2.3 Prevalence of Inflammatory Bowel Disease (IBD)

The global prevalence of IBD has risen from 3.7 million in 1990 to 6.8 million in 2017. North America has the highest prevalence (422 cases per 100,000), while the Caribbean has the lowest (6.7 cases per 100,000)(4,26,27).

The incidence of Crohn's disease and ulcerative colitis is lower in Asia and the Middle East, but it has been rising in newly industrialized countries in Africa, Asia, and South America(28–30). In a systematic review of population-based studies on Crohn disease and ulcerative colitis incidence, Brazil showed an annual percentage change (APC) increase of 11.1% (95% CI 4.8-

17.8) for Crohn disease and 14.9% (95% CI 10.4-19.6) for ulcerative colitis. In Taiwan, the APC increased by 4% (95% CI 1.0-7.1) for Crohn disease and 4.8% (95% CI 1.8-8.0) for ulcerative colitis(20). There is a north-to-south gradient, with higher incidence rates of Crohn disease and ulcerative colitis in northern regions compared to southern ones (31,32). This trend may be related to less sunlight and vitamin D exposure as risk factors for IBD(33–36).

The disease course varies widely among patients, with differing durations and frequencies of relapses and quiescent periods. Inflammatory bowel disease (IBD) can lead to malnutrition due to inflammation and nutrient imbalance. Factors linked to relapse risk include frequent flares in the first year, poor medication adherence, and active smoking in Crohn disease (CD) patients, but these are insufficient for predicting disease progression. Further identification of relapse contributing factors is needed (37–40)

IBD patients risk impaired nutritional status due to disease-related changes in absorption and requirements, often coupled with unbalanced dietary intake (41) . Reported prevalence's range from 16 to 75% in IBD patients(10,42,43). Variation may stem from differences in study methods and definitions of impaired nutritional status, often termed malnutrition, which remains difficult to define.

Nutritional status is typically assessed using anthropometric measures like height, weight, BMI, body circumferences, and skinfold thickness. While these parameters improve with IBD treatment, they may not accurately reflect changes in body composition (44). Measuring body composition is better for identifying subtle signs of malnutrition and sarcopenia, enhancing understanding of nutritional status and enabling prioritization of corrective actions.

The American Society of Parenteral and Enteral Nutrition (ASPEN) recommends that two of the following six criteria be met to diagnose malnutrition in adults: low energy intake, weight loss, muscle mass loss, subcutaneous fat loss, fluid accumulation, and reduced handgrip strength(45). Validated screening tools for identifying malnutrition risk, like the Short Nutritional Assessment Questionnaire (SNAQ) and the Malnutrition Universal Screening Tool (MUST), are preferred due to their efficiency (25).

Impaired nutritional status can affect disease course, with malnutrition—assessed by the Subjective Global Assessment—linked to reduced quality of life in hospitalized IBD patients.

Additionally, radiologically assessed muscle mass loss is associated with a higher risk of intestinal resection and postoperative complications in IBD patients(46–50).

Factors Associated with Active Disease at Inclusion

Factors influencing disease activity in IBD patients include demographics, clinical aspects, and socioeconomic status (SES). Younger patients often show higher odds of active Crohn's Disease (CD), with those under 40 having up to 1.5 times the likelihood compared to older patients. Males may also have greater risk for active Ulcerative Colitis (UC), with odds ratios (ORs) of 1.2 to 1.5. Lower SES correlates with delayed treatment and increased risk of active disease (OR = 1.6–2.0) (13,14).

Disease-specific factors are strong predictors of IBD activity. Extensive ulcerative colitis (UC) has higher odds of active disease (OR = 2.4) compared to limited cases, while ileocolonic disease and perianal involvement in Crohn's Disease (CD) also raise risk. Longer disease duration and frequent flares increase odds by 20% per flare (OR = 1.2). Complications such as strictures and fistulas in CD further heighten the likelihood of active disease, with ORs between 1.5 and 3.0 (12).

Clinical and treatment factors are key predictors of disease activity. Non-adherence to medication increases the odds of active disease by about twofold (OR = 2.0–2.5). Additionally, prior surgical interventions, like bowel resections, may elevate the risk due to complications such as strictures. Lifestyle and psychosocial factors, such as smoking, diet, and stress, significantly influence disease activity. Smoking increases active disease risk in Crohn's Disease (OR = 1.8–2.5) but may protect against Ulcerative Colitis, while high stress and poor mental health correlate with a 1.5 times greater risk of active disease.

Higher disease activity is linked to a lower skeletal muscle index in Ulcerative Colitis patients. (47). Previous studies show that active disease impacts body composition in both Crohn's Disease and Ulcerative Colitis patients (51–53). Patients with quiescent Crohn's Disease and Ulcerative Colitis can still experience altered body composition, including changes in fat mass and fat-free mass (54,55). A prior study found that the nutritional status of recently diagnosed IBD patients is negatively affected (56). We hypothesize that impaired nutritional status may increase the risk of disease activity. This study aimed to analyse the association between

nutritional status and disease activity in IBD outpatients through a longitudinal observational design. Predictors of active disease in IBD patients are multifaceted, including demographic, disease-specific, clinical, and lifestyle factors, and understanding these can enhance early intervention and disease management outcomes.

Conceptual framework

This conceptual framework, developed from a literature review, outlines key factors associated with active disease in Inflammatory Bowel Disease (IBD) patients, categorized into four groups. Demographic and Socioeconomic Factors include age, gender, and socioeconomic status, which influence healthcare access and disease risk. Disease-Specific Factors focus on the type of IBD, disease duration, and complications that affect severity. Clinical and Treatment Factors encompass medication use, treatment adherence, and surgical history, all of which impact disease control. Finally, Lifestyle and Psychosocial Factors address behaviours like smoking and diet, along with mental health and physical activity, which contribute to disease activity and patient outcomes. This framework serves as a comprehensive guide to understanding the multifaceted nature of IBD disease activity.

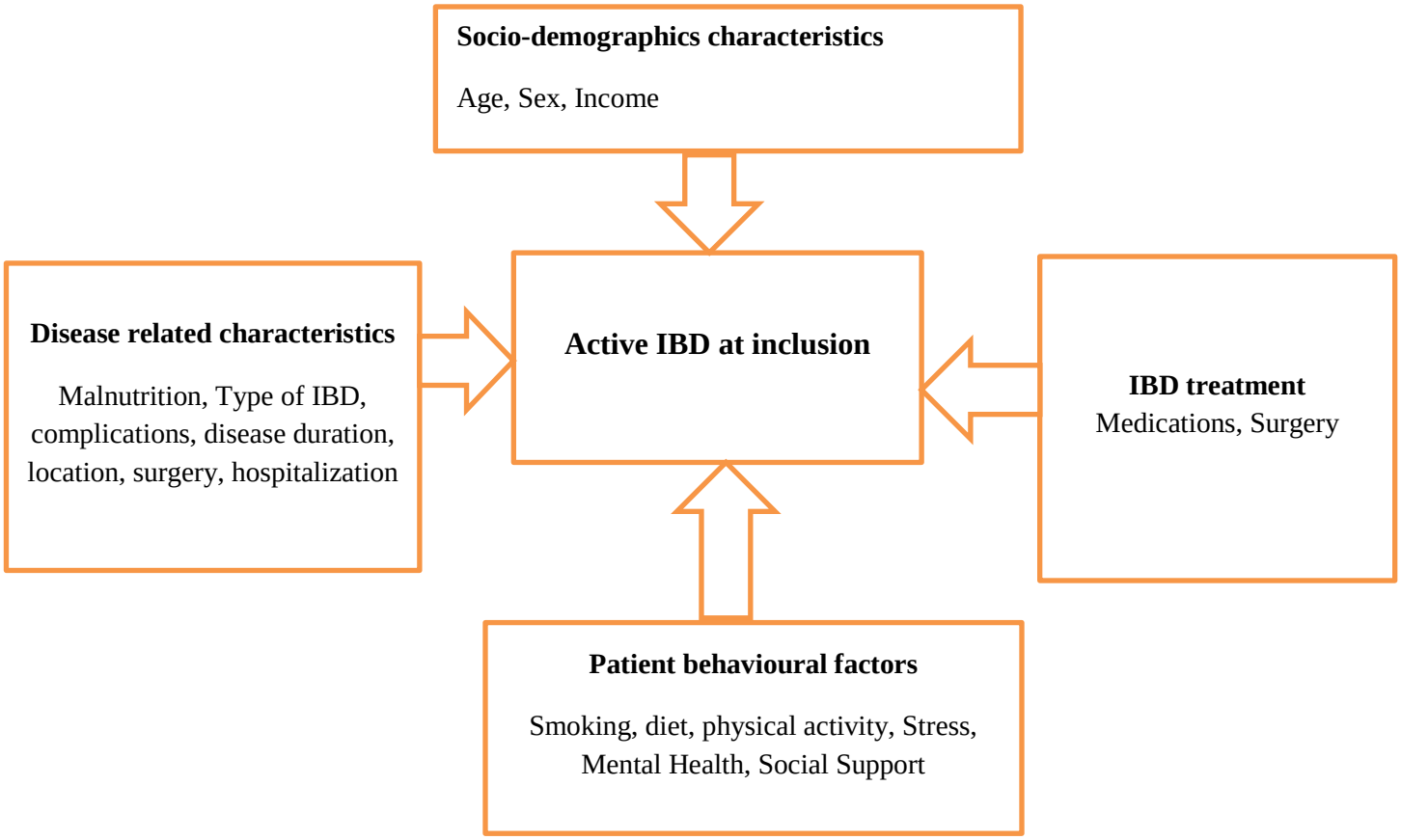

Fig 1: Factors that affect active disease at inclusion among IBD patients, 2024

3. OBJECTIVE

General objective

- To assess the nutritional status and proportion of active disease at inclusion among patient with inflammatory bowel disease in Tikur Anbessa Specialized Hospital and Adera Medical and Surgical Center, Ethiopia, 2024

Specific objective

- To assess the proportion of patients at risk of malnutrition using NST (nutritional screening tools) and those with malnutrition using NAT (nutritional assessment tools) among patients with inflammatory bowel disease in Tikur Anbessa Specialized Hospital and Adera Medical and Surgical Center, Ethiopia, 2024
- To assess the magnitude of active disease at inclusion among patients with inflammatory bowel disease in Tikur Anbessa Specialized Hospital and Adera Medical and Surgical Center, Ethiopia, 2024
- To identify determinants of disease activity among IBD patient at Tikur Anbessa Specialized Hospital and Adera Medical and Surgical Center, Ethiopia, 2024

4. Methods

4.1 Study area

The study was conducted at Tikur Anbessa Specialised Hospital (TASH), and Adera Medical and Surgical Center both of which are located in Addis Ababa, the capital city of Ethiopia. The hospitals have gastroenterology and hepatology division which provides training for medical residents, GI fellows and undergraduate students parallel to several clinical services. Services delivered by the unit include; diagnostic and therapeutic scope services in addition to inpatient and outpatient clinical services.

4.2 Study period

The study period was from February, 2024 to July, 2024 G.C.

4.3 Study design

A prospective cross-sectional study was conducted to assess the malnutrition risk screening, assessment and disease activity among patient with inflammatory bowel disease in Tikur Anbessa Specialized Hospital and Adera Medical and Surgical Center, Ethiopia, 2024.

4.4 Source population

All Adult IBD patients diagnosed as Crohn's or ulcerative colitis who are having follow up in Outpatient department of Tikur Anbessa Specialized Hospital and Adera Medical and Surgical Center.

4.5 Study population

All Adult IBD patients diagnosed as Crohn's or ulcerative colitis who are having follow up in Tikur Anbessa Specialized Hospital and Adera Medical and Surgical Center outpatient department for follow up during the study period and consent to participate and fulfilled the inclusion criteria.

4.5.1 Eligibility criteria

4.5.1.1 Inclusion criteria

All Adult IBD patients aged 18 years and above diagnosed as Crohn's or ulcerative colitis who are having follow up was included in the study.

4.5.1.2 Exclusion criteria

Patients who are severely ill, pregnant women, decompensated cirrhosis, heart failure, malignancies, not able to communicate, incomplete data,RVI,TB, and patients who refused to give consent to participate was excluded from the study.

4.6 Sample size

The sample size was calculated by using EPI Info software version 7.2.3.1 with the following Parameters: significance = 95%; power = 80%, using a single population proportion formula assuming proportion of malnutrition among IBD patients from a north Indian cohort of patients with CD, high prevalence rates of 82.8% malnutrition were reported(57). The calculated sample size is 219 and when the 15% non-response rate is added the final sample size was 252. The sample size is calculated as follows.

$$n = \frac{z^2_{\alpha/2} * p(1-p)}{w^2}$$

Where:

α = the level of significance

P= best estimate of population proportion, taken as 82.8 % from a study done in India (48).

W= maximum acceptable difference (absolute precision) (0.05).

Zα/2 = the value under standard normal table for the given value of confidence level (e.g. for α = 0.05 the Z0.025 = 1.96).

n=Sample size

4.7 Sampling procedures

A consecutive sampling technique was used to select the study subjects.

4.8 Study variables

Dependent variables: The presence or absence of active disease at inclusion among IBD patients is the dependent variable.

Independent variables: The independent variables were socio-demographic factors (sex, age, education status, residence, marital status, occupation), behavioural risk factors (cigarette smoking), health profiles, and nutritional risk factors.

4.9 Data collection procedures

4.9.1 Data collection tool

Data was collected from medical record of patients using checklist and by interviewing the study participants using structured questionnaire after getting a verbal informed consent from the participants. Questionnaire and check list was developed by reviewing different relevant literatures. To collect BMI data, each participant's weight in kilograms (kg) and height in meters was measured accurately. Both measurements were recorded , ensuring no shoes or heavy clothing are worn.and

Weight was measured by weighing scale and Height initially measured by non stretching tape meter and marking was done on the wall and later measured from the ground to the mark later this was changed to stadiometer and cross-check up of patients who are measured by tape meter and stadiometer was done on the subsequent follow up and found to be consistent

Then BMI was calculated by dividing weight by the square of height (BMI = weight/height^2). To collect Mid-Upper Arm Circumference (MUAC) data, I haved located the midpoint between the shoulder (acromion) and elbow on the participant's left arm. Using a MUAC tape measurement of the circumference was made at this point, ensuring the arm is relaxed and hanging by the side. The measurement was recorded in centimetres without compressing the arm.

4.9.2 Data quality assurance

The questionnaire was initially prepared in English, and this was translated into Amharic. This questionnaire, prepared in Amharic, was translated back to English to ensure consistency. Data was collected by General practitioners (GP) and Training was given to data collector by the principal investigator

The questionnaire was pre-tested on 5% of the total sample size a week prior to the actual data collection. Furthermore, the principal investigator has given feedback and corrections on daily

basis to the data collector. Completion, accuracy, consistency and clarity of the collected data was checked carefully on a regularly basis.

4.10 Operational definitions

Malnutrition

A patient was considered to be malnourished if he/she had one of the following: a BMI below 18.5 kg/m^2, or an SGA grade B or C(24).

Body mass index

Weight [kg] divided by squared height [m]. BMI values were classified as follows: underweight: <18.5 kg/m^2; normal: 18.5–25 kg/m^2; overweight >25–29.9 kg/m^2; obesity 30 kg/m^2 (24).

Malnutrition Universal Screening Tool (MUST)

MUST was classified as 0: Low risk for malnutrition 1: Medium risk for malnutrition, ≥ 2: High risk for malnutrition, refer to nutritional support team(58).

Subjective Global Assessment

SGA was classified as: grade A, well nourished; grade B, moderately malnourished; and grade C, severely malnourished(59).

Disease activity

For luminal CD, clinical activity was defined as a Harvey–Bradshaw index score >4 points(60). For UC, clinical activity was defined as a partial Mayo score >2 points(61).

MUAC category

< 18.0 cm (Adults includes both non-pregnant, pregnant, and postpartum adults) categorized as severe, 8–21 cm categorized moderate and > 21 cm were categorized normal(62).

4.11 Data management and analysis

The collected data was entered into Epi data version 4.6.0.2 and analyzed using SPSS version 25. Percentages and frequencies were used to summarize categorical variables. The results were presented by tables and graphs based on the nature of variable. Distribution of the continuous variables was checked for normality distribution. Mean with standard deviation and median with interquartile range was used to summarize normally and non-normally distributed continuous variables respectively.

Analysis using bivariate logistic regression model was used to see the association between the explanatory variables and the outcome variable. This was followed by multivariable logistic regression analysis using those variables with P-value ≤0.25 in the bivariable analysis. The Odds ratio with 95% CI will be used to measure the strength between the dependent and the independent variables. The P Value < 0.05 will be used to determine the level of statistical significance. To check the goodness of fit of the statistical model, the Hosmer-Lem show test was used. Multicollinearity was assessed by Tolerance test and variance inflation factor. Linear correlation analysis was done to check linear correlation between continuous parameters of nutritional variables and clinical activity of disease. Chi-square test with p value was use to show the statistical difference of clinical activity among predictors of IBD patients.

4.12 Ethical consideration

Ethical clearance was obtained from Addis Ababa University, College of Health science department of I. Medicine, Ethical review board. The information obtained from the chart and the study participants will remain confidential indefinitely. Data will be kept confidential and anonymous throughout the study. Personal identifier was not used in the study.

4.13 Dissemination of results

The result of the study will be disseminated to relevant authorities including Addis Ababa University, College of health sciences. Results will be discussed with quality assurance team of the hospital. The result will also be disseminated through publication in peer reviewed local and international journals and through presenting it in relevant workshops and seminars. The copy will be placed in the library as references.

5. Result

General about participants

Total of 242 individual were participated with response rate of 96.03%. Majority of them were Crohn's disease 190(78.51%) disease and the rest were 52 (21.49%) ulcerative colitis (Fig 3).

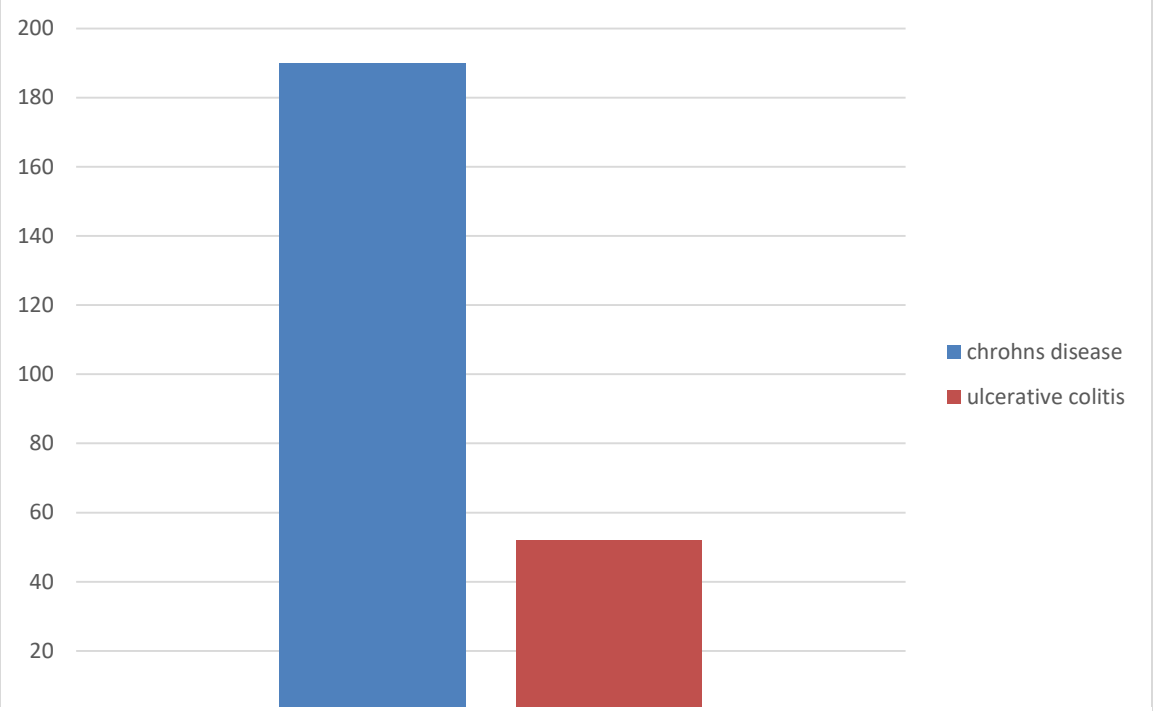

Fig. 3. Major types of IBD among patient patients at TASH and Adera center Addis Ababa 2024

Sociodemographic characteristics

Majority of participants were female (65.7%), with males comprising 34.3%. The mean age of participants was 32.27 with standard deviation of 10 years. In terms of marital status, 48.35% are married, 46.49% are single, and a small percentage is either widowed (1.65%) or divorced (3.31%). The vast majority of participants reside in urban areas (94.21%), while only 5.79% live in rural settings. Educational attainment varies, with 46.28% having a college education or higher, followed by 33.48% with Grade 9-12 education, 12.4% with Grade 1-8 education, and 7.43% with no formal education. Employment status shows that 36.36% are employed, though a substantial 32.64% are currently without a job. Income data reveals that 59.17% of participants earn between 1001-5000 Ethiopian Birr monthly. Finally, the mean age at diagnosis of Inflammatory Bowel Disease (IBD) among the participants is 28.01 years, with a standard deviation of 10.83 years (**Table 1**).

Table 1: Demographic and Socioeconomic Profile Among IBD Patients Addis Ababa Ethiopia, 2024

No	Variable	Category	Total (%)	CD (190)		UC (52)	
				Active	Non active	Active	Non active
1	Sex	Male Female	83(34.30) 159(65.70)	23 37	40 90	11 11	9 21
2	Age (years)	Mean ±SD	32.27 ± 10.77	31.52 ± 10.28		35±12.09	
3	Marital status	Single Married Divorced Widowed	113(46.49) 117(48.35) 8(3.31) 4(1.65)	33 21 5 1	63 63 3 1	6 15 0 1	11 18 0 1
4	Place of residence	Urban Rural	228(94.21) 14(5.79)	57 3	125 5	18 4	28 2
5	Level of education	No formal education Grade 1-8 Grade 9-12 College and above	18(7.44) 30(12.40) 82(33.88) 112(46.28)	4 10 19 27	9 13 45 63	3 3 6 10	2 4 12 12
6	Current occupation	No job Employed Student Labour worker Retired	79 (32.64) 88(36.36) 51(21.07) 21(8.68) 3(0.01)	15 24 17 3 1	43 49 27 9 2	8 8 1 5 0	13 7 6 4 0
7	Monthly income (ETB)	<500 500 – 1000 1001 – 5000 >5000	19(7.85) 36(14.88) 119(49.17) 68(28.10)	7 4 38 11	7 24 60 39	2 3 7 10	3 5 14 8
8	Age at Dx	Mean ±SD	28.01±10.83	27.69 ± 9.67		30.67 ±12.71	

	of IBD				

Patient clinical and comorbidity characteristics

The information below summarizes clinical data on patients with Inflammatory Bowel Disease focusing on the characteristics of Crohn's disease (CD) and Ulcerative Colitis (UC). Among those with CD, the most common disease location is Ileocolonic (51.03%), followed by Ileal (32.63%) and Colonic involvement (8.95%), with a few cases of Perianal disease (7.37%). In terms of disease behaviour, most CD cases are either stricturing (41.05%) or non-stricturing/non-penetrating (38.42%), with a smaller percentage presenting with penetrating behaviour (20.53%). For those with UC, pancolitis is the most common extent of disease (44.23%), followed by Proctitis (28.85%) and left-sided disease (26.92%).

Additionally, nearly all patients are non-smokers (98.76%), and about a third (31.82%) have undergone surgery for IBD. Nearly one quarter (23.14%) have a history of hospitalization due to IBD, with most of these patients experiencing only a single hospitalization (60.71%). Finally, the vast majority of patients do not have chronic comorbidities (92.15%), with only a few (7.85%) reporting conditions such as psychiatric diseases, diabetes, hypertension or stroke. Regarding IBD treatment 32(13.22%) individuals were not taking any medication of IBD. Among those on medications, 147(60.74%) were on immunomodulators and 50(20.66%) were taking combined medication more than one category of IBD treatment, 7(2.89%) were taking 5-ASA, 6(2.48%) taking steroids only. No patient was on biologic (Table 2).

Table 2: Clinical Characteristics and Disease Profiles of IBD Patients, Addis Ababa, Ethiopia: 2024

No	**Variables**	**Category**	**Total**	**CD**		**UC**	
				Active	**Non active**	**Active**	**Non active**
1	Disease location for (CD)	Ileal Colonic Ileocolonic Perianal	62(32.63) 17(8.95) 97(51.03) 14(7.37)	25 3 25 7	37 14 72 7		
2	Disease behaviour for (CD) 68.4% in remission	None stricturing/none penetrating Stricturing Penetrating	73(38.42) 78(41.05) 39(20.53)	19 26 15	54 52 24		

3	Disease extent for (UC) 57.7% in remission	Proctitis Pancolitis left-sided	15(28.85) 23(44.23) 14(26.92)			5 10 7	10 13 7
4	Disease duration at inclusion (years)	Mean ±SD	4.06± 3.73	4.11 ± 3.65		4.019 ± 3.99	
5	Medication use for IBD at inclusion	None 5-ASA Steroids Immunomodulators Combined (more than one category of IBD treatment)	32(13.22) 7(2.89) 6(2.48) 147(60.74) 50(20.66)	6 0 1 40 13	16 0 1 95 18	2 4 2 6 8	8 3 2 6 11
6	Current smoking at inclusion	Yes No	3(1.24) 239(98.76)	2 58	1 129	0 22	0 30
7	Previous surgery for IBD	Yes No	77(31.82) 165(68.18)	18(26) 42(38)	55 75	2 20	2 28
8	History of hospitalizations due to IBD	Yes No	56(23.14) 186(76.86)	17(41) 43(31.7)	29 101	6 16	4 26
9	Number of hospitalizations due to IBD	 One Greater than one	 34(60.71) 22(39.28)	 11 6	 19 10	 2 4	 2 2
10	Chronic comorbidities	Yes (hypertension, DM, stroke, psychiatric disease, .) No	19(7.85) 223(92.15)	5 55	8 122	2 20	4 26

Biochemical and Nutritional characteristics of IBD patients

The majority of individuals (81.82%) do not use nutritional supplements or vitamins, with only a small proportion (18.18%) reporting usage. When looking at Body Mass Index (BMI), most individuals fall within the normal weight category (52.07%), while a smaller percentage are underweight (32.23%), overweight (11.98%), or obese (3.72%). There is statistically significant difference between active and non-active disease in Crohn's disease (p value ,0.014), but it is non-significant in ulcerative colitis between active and non-active disease (p value ,0.142).

Regarding MUAC, most (78.10%) had normal range, 15.29% moderate and 6.61% severe malnutrition. When we see difference in MUAC there is no significant difference between clinical activity of disease both in CD (p value, 0.170) and UC (p value, 0.334). The MUST screening found that substantial proportion (34.30%) and (21.90%) of patients are at high risk and medium risk of malnutrition respectively and 43.80% at low risk. The Pearson chi-square test show that MUST score is significantly different between active and non-active disease both in CD (0.000) and UC (0.00). More than half of the patients are found to have moderate (26.86%) or severe (24.79%) malnutrition on the Subjective Global Assessment (SAG) and only

48.35% are well-nourished. Moreover, SGA is statistically different between clinical activity of CD patients (0.014), but the difference in UC non-significant (0.170). In terms of inflammatory markers, most individuals have normal C-reactive protein (CRP) levels 155(64.05%); while a quarter exhibit elevated CRP 87(35.95%). It is meaningfully different among clinical activity of IBD patient in ulcerative colitis (0.016). For Erythrocyte Sedimentation Rate (ESR), a larger proportion have elevated levels (69.12%) compared to those with normal levels (30.58%) (Table 3).

Table 3: Biochemical and Nutritional characteristics of IBD patients at TASH and Adera Medical centre 2024

No	Variable	Value	Total (%)	CD			UC		
				Active	No-active	P value	Active	Non active	P value
1	Use of nutritional supplements and vitamins	Yes No	44(18.18) 198(81.82)	15 45	24 106	0.300	4 18	1 29	0.073
2	BMI Kg/m2	Underweight Normal Overweight Obesity	78(32.23) 126(52.07) 29(11.98) 9(3.72)	28 29 2 1	40 66 19 5	**0.040**	7 11 2 2	3 20 6 1	0.142
3	MUAC	Severe Malnutrition Moderate Malnutrition Normal	16(6.61) 37(15.29) 189(78.10)	6 14 40	9 18 103	0.170	1 3 18	0 2 28	0.334
4	MUST Score Category	Low risk Medium risk High risk	106(43.80) 53(21.90) 83(34.30)	14 16 30	69 26 35	**0.000**	5 5 12	18 6 6	**0.000**
5	SGA Category	Well nourished Moderately malnourished Severely malnourished	117(48.35) 65(26.86) 60(24.79)	17 21 22	70 29 31	**0.014**	10 7 5	20 8 2	0.170
6	Haemoglobin(mg/dl)	Mean ± SD	39.70 ±20.07	38.90±20.81		0.8874	42.61 ± 16.99		0.4128
7	Leucocytes/Miroli	Mean ± SD	6.27± 30.03	6.310 ±29.74		0.5664	6.12 ± 31.34		0.1808
8	Albumin (89)(mg/dl)	Mean ± SD	3.37±1.09	3.41±1.12			3.27±1.07		
9	C-reactive protein	Normal Elevated	155(64.05) 87(35.95)	40 20	86 44	0.945	8 14	21 9	**0.016**
10	ESR	Normal Elevated	74(30.58) 168(69.042	23 38	37 92	0.212	4 18	9 21	0.331

Magnitude of disease activity and categories among IBD patients

Regarding disease activity, the majority of CD patients are in remission 150(78.95%), with fewer experiencing mild 33(17.37%) or moderate 7(3.68%) disease activity, and none showing severe disease. Most UC patients are also in remission 35(67.31%), with a smaller number experiencing mild 10(19.23%), moderate 6(11.54%), or severe 1(1.92%) disease Fig 4.

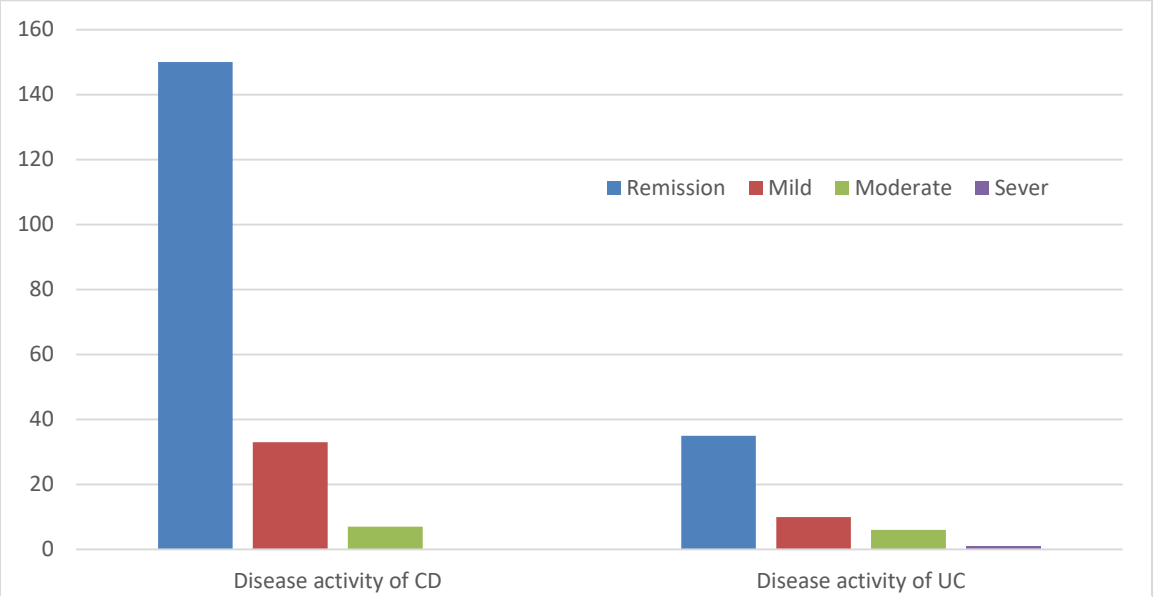

Fig 4: Magnitude of disease activity and categories among IBD patients

Over all 160 (66.12%) of the patient had clinical features of No active IBD disease while 82(33.88%) have features of active disease (in clinical remission) at inclusion to the study (**Fig 5).**

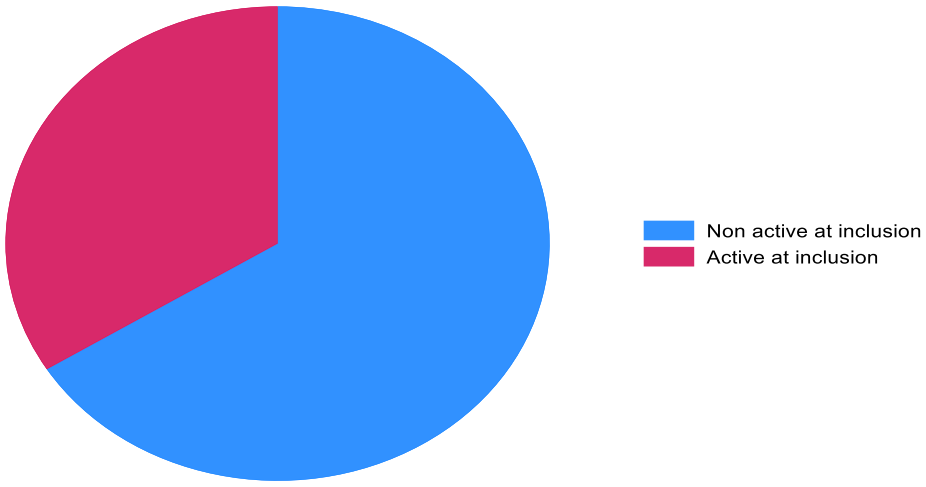

Fig 5: Disease activity of IBD patients at inclusion in Addis Ababa Ethiopia 2024

Correlation of nutritional status and disease activity among IBD patients in Addis Ababa Ethiopia 2024

The information below demonstrates that patient's nutritional status such as BMI were significantly correlated with disease activity (ro -0.1644, p =0.015), even if it is weak. Whereas MUST score is positively correlated with clinical activity of disease with correlation coefficient of (ro=0.4304 P=0.000). Moreover, MUAC is negatively and weakly correlated with disease activity of IBD patients (ro=-0.1687, p value 0.0086) (Table 4)

Table 4: Correlation of nutritional status and disease activity among IBD patients in Addis Ababa Ethiopia 2024

Variables	**Over all IBD**		**Crohn's disease**		**Ulcerative colitis**	
	spearman ro	P value	spearman ro	P-value	spearman ro	P-value
BMI	-0.1644	0.0105	-0.1901	0.0087	-0.1038	0.4621
MUST score	0.4304	0.000	0.3867	0.000	0.6135	0.000
ALBUMIN	0.0445	0.4896	-0.1221	0.0965	0.0071	0.9693
MUAC	-0.1687	0.0086	-0.1981	0.0062	-0.1039	0.4614

Factors that affect disease activity among Crohn's disease patients

Out of the total variables analysed, 10 were identified as candidates for the multivariate analysis based on their p-values being ≤0.25. These variables include income, marital status, occupation, disease location and behaviour of Crohn's Disease (CD), history of surgery for IBD, smoking history, SGA score, MUST score, BMI, ESR.

In the multivariate analysis, three variables remained significant after adjusting for others. Notably, perianal disease location in CD was strongly associated with a higher risk of active disease, with an adjusted odds ratio (AOR) of 7.70 (95% CI: 1.04–56.93, p=0.045). Additionally, a high MUST score emerged as a robust predictor of active disease, with an AOR of 4.98 (95% CI: 1.36,18.18, p=0.015) and medium MUST score is again about 3.59 times increased risk with AOR 3.59(1.06,12.20 p=0.040) compared to low score. Income was also significant, with patients earning 500-100showing a significantly lower risk of active disease (AOR: 0.12, 95%CI:021,0.69, p=0.018) compare to those earning lower than 500ETB. However, some variables, such as the SGA score, lost significance after adjustment (Table 5).

Table 5: Factors that affect disease activity among Crohn's disease patients 2024

No	**Variable**	**Category**	**Active disease at in**		**COR(CI)**	**P value**	**AOR(CI)**	**P value**
			Yes	No				
1	Sex	Female	23	40	Ref	0.304		
		Male	37	90	1.39(0.73,2.65)			
2	Age in years	Mean ± SD	35 ± 12		1.00(0.97,1.03)	0.898		
3	Marital status	Single	33	63	**Ref**	**Ref**	**Ref**	**Ref**
		Married	21	63	0.63(0.33,1.21)	**0.172**	0.42(0.15,1.18)	0.101
		Widowed	1	1	1.90(011,31.51)	0.651	3.56(0.05,249.75)	0.558
		Divorced	5	3	3.18(0.71,14.14)	**0.128**	1.88(0.23,15.35)	0.555
4	Place of residence	Rural	57	125	**Ref**	0.714		
		Urban	3	5	0.76(0.17,3.28)			
5	Level of education	No formal	4	9	**Ref**	**Ref**		
		Grade 1-8	10	13	1.73(0.41,7.28)	0.455		
		Grade 9-12	19	45	0.95(0.26,3.46)	0.938		
		College and above	27	63	0.96(0.27,3.40)	0.955		
6	Current occupation	No job	15	43	**Ref**	**Ref**	Ref	Ref
		Employed	24	49	1.40(0.65,3.01)	0.384	1.70(0.61,4.71)	0.304
		Student	17	27	1.80(0.77,4.20)	**0.171**	1.62(0.0.42,6.23)	0.479
		Labour	3	9	0.95(0.22,4.00)	0.950	1.25(0.20,7.73)	0.809
		worker	1	2	1.43(0.12,16.96)	0.775	3.54(0.15,81.03)	0.427
		Retired						
7	Income	500	7	7	Ref	Ref	Ref	Ref
		500 – 1000	4	24	0.16(0.037,0.73)	**0.018**	0.12(0.0.02,0.69)	**0.018**
		1001 – 5000	38	60	0.63(0.20,1.94)	0.426	0.91(0.21,3.94)	**0.902**
		>5000	11	39	0.28(0.08,0.97)	**0.046**	0.48(0.07,2.92)	**0.428**

8	Disease location of CD	Colonic Ileal Ileocolonic Perianal	3 25 25 7	14 37 72 7	Ref 3.43(0.90,13.12) 1.59(0.42,6.00) 7(0.79,61.97)	**Ref** **0.071** 0.489 **0.080**	**Ref** 3.65(0.73,18.13) 2.37(0.50,11.14) 7.70(1.04,56.93)	**Ref** 0.113 0.274 0.045
9	Disease behaviour	None Stricturing Penetrating	19 26 15	54 52 24	Ref 1.42(0.70,2.87) 1.77(0.77,4.07)	Ref **0.175** 0.328	**Ref** 2.39(0.0.95,6.01) 2.00(0.0.61,6.59)	**Ref** 0.064 0.251
10	Disease duration at inclusion (years)	Mean ±SD	4.06± 3.73			0.350		
11	Current smoking	Yes No	2 58	1 129	Ref 4.44(0.39,50.04)	**0.227**	2.93(0.14,58.24)	0.479
12	Medication use of IBD at inclusion	None Yes	6 54	16 114	Ref 3.99(0.19,84.19	Ref 0.37	Ref 13.64(0.27,67.66)	Ref 0.190
13	Hx of surgery for IBD	Yes No	18 42	55 75	Ref 0.58(0.30,1.12)	**0.107**	0.42(0.0.17,1.05)	0.065
14	Hospitalizations due to IBD	No Yes	17 43	29 101	Ref 1.37(0.68,2.76)	**Ref** **0.**368		
15	Chronic comorbidities (Htn,DM,stroke,psy	No Yes	5 55	8 122	Ref 1.38(0.43,4.43)	Ref 0.582		
16	Haemoglobin(mg/dl)	Mean ± SD	38.90±20.81			0.978		
17	Leucocytes/micro liter	Mean ±SD	6.310 ±29.74			0.646		
18	Must score	Low risk Medium risk High risk	14 16 30	69 26 35	Ref 3.03(1.29,7.07) 4.22(1.98,8.97)	Ref **0.000** **0.00**	Ref 3.59(1.06,12.20) 4.98(1.36,18.18)	Ref **0.40** **0.015**
19	SGA score	Grade A Grade B Grade C	17 21 22	70 29 31	Ref 2.98(1.37,6.45) 2.92(1.36,6.25)	Ref **0.006** **0.006**	Ref 1.29(0.40,4.10) 0.69(0.15,3.08)	Ref 0.665 0.635
20	ESR	Normal Elevated	23 37	38 92	Ref 0.66(0.34,1.26)	Ref 0.213	Ref 0.66(0.29,1.51)	0.333
21	CRP	Normal Elevated	45 15	107 23	Ref 0.97(0.51,1.86)	0.945		
22	BMI	Underweight Normal Overweight Obesity	28 29 2 1	40 66 29 5	Ref 0.62(0.32,1.20) 0.15(0.03,0.69) 0.28(0.03,2.58)	Ref 0.61 **0.016** 0.265	Ref 1.18(0.38,3.61) 0.76(0.09,6.40) 0.60(0.02,15.55)	Ref 0.764 0.808 0.760

Factors that affect disease activity among ulcerative colitis patients

In ulcerative colitis variables include sex, place of residence, use of medication at inclusion, leucocytes, history of hospitalization, BMI, MUST, SGA, CRP were identified as candidates for the multivariate analysis based on their p-values being ≤0.25 during univariate analysis.

In the multivariate analysis, two variables remained significant after adjusting for others. Notably, CRP was strongly associated with a higher risk of active disease, with an adjusted odds ratio AOR of 5.78 (95% CI: 1.01, 33.17, p=0.049). Additionally, a high MUST score emerged as a robust predictor of active disease, with an AOR of 7.57 (95% CI: 1.06, 53.96, p=0.043). However, some variables, such as the SGA score, BMI, medication exposure lost significance after adjustment (Table 6).

Table 6: Factors that affect disease activity among ulcerative colitis disease

No	**Variable**	**Category**	**Active disease at in**		**COR(CI)**	**P value**	**AOR(CI)**	**P value**
			Yes	No				
1	Sex	Female Male	11 11	9 21	Ref 2.33(0.74,7.32)	**0.147**	3.44(0.59,19.85)	0.166
2	Age in years	Mean SD	35±12.09		1.02(0.97,1.03)	0.310		
3	Marital status	Single Married Widowed Divorced	6 15 1 0	11 18 1 0	Ref 1.52(0.45,5.11) 1.83(0.09,34.84)	Ref 0.492 0.687		
4	Place of residence	Rural Urban	18 4	28 2	Ref 0.32(0.05,1.94)	**0.216**	1.36 (0.04,31.06)	0.843
5	Level of education	No formal Grade 1-8 Grade 9-12 College and above	3 3 6 10	2 4 12 12	**Ref** 0.50(0.04,5.15) 0.33(0.04,2.56) 0.55(0.07,4.00)	**Ref** 0.560 0.291 0.560		
6	Current occupation	No job Employed Student Labour worker Retired	8 8 1 5 0	13 7 6 4 0	**Ref** 1.85(0.48,7.11) 0.27(0.02,2.68) 2.03(0.41,9.88)	Ref 0.366 0.264 0.380		
7	Income	500 500 – 1000 1001 – 5000 >5000	2 3 7 10	3 5 14 8	Ref 0.75(0.10,5.57) 0.90(0.09,8.89) 1.87(0.24,14.08)	**Ref** 0.779 0.928 0.541		
8	Age at the diagnosis of IBD	Mean ±SD	30.67 ±12.71		1.00(0.95,1.04)	0.997		

9	Disease's duration	Mean ±SD	4.019 ± 3.99		1.07(0.93,1.23)	0.308		
10	Disease extent of UC	Left sided colitis Pancolitis Proctitis	5 10 7	10 13 7	Ref 0.76()0.20,2.91 0.50(0.11,2.24)	Ref 0.700 0.365		
11	IBD Medication use at inclusion	None Yes	2 20	8 22	Ref 2.63(0.34,20.34)	Ref **0.215**	Ref 2.63(0.34,20.34	Ref 0.353
12	Hx of surgery for IBD	No Yes	2 20	2 28	Ref 1.40(0.18,10.79)	0.747		
13	Hospitalizations due to IBD	No Yes	6 16	4 26	Ref 2.43(0.59,9.98)	**0.216**	**Ref** 3.55(0.53,23.76)	0.191
14	Chronic comorbidities	No Yes	2 20	4 26	Ref 0.65(0.10,3.91)	0.638		
15	Haemoglobin(mg/dl)	Mean ±SD	42.61± 16.99		1.00(0.97,1.04)	0.589		
16	Leucocytes/microliter	Mean ±SD	6.12±31.34		0.98(0.96,1.00)	**0.148**	0.97(0.94,1.00)	0.111
17	Must score	Low risk Medium risk High risk	5 5 12	18 6 6	Ref 13.33(2.20,80.51) 30(4.75,189.29)	**Ref** **0.000** **0.005**	Ref 4.32 (0.513,36.36) 7.57(1.06,53.96)	**Ref** **0.178** **0.043**
18	SGA score	Grade A Grade B Grade C	10 7 5	20 8 2	Ref 1.75(0.49,6.12) 5(0.82,30.46)	Ref **0.387** **0.081**	Ref 0.33(0.04,2.60) 0.09(0.00,11.84)	Ref 0.297 0.344
19	ESR	Normal Elevated	10 5	20 4	Ref 1.18(0.37,8.73)	Ref 0.455		
20	CRP	Normal Elevated	8 14	21 9	Ref 4.08(1.26,13.13)	**0.012**	5.78(1.06,32.67)	**0.049**
21	BMI	Underweight Normal Overweight Obesity	7 11 2 2	3 20 6 1	Ref 0.23(0.05,1.09) 0.14(0.017,1.16) 0.85(0.05,13.47)	Ref **0.066** **0.069** **0.913**	Ref 0.07(0.02,4.18) 0.03(0.00,4.61) 0.55(0.00,83.88)	Ref 0.208 0.180 0.816

Factors associated with disease activity of inflammatory bowel disease both Crohn's disease and ulcerative colitis

In our bivariate logistic regression analysis, from total variables, 12 variables met the specified criteria which is p value ≤0.25 to be included in the multivariable analysis were sex, place of residence, marital status, income, type of IBD, history of surgery for IBD, hospitalizations due to IBD, MUST score, SGA score, BMI, leucocytes, CRP.

Lastly in multivariable analysis income and MUST score become statistically significant at p value 0.05 after adjusting for covariates. IBD patients with income between 500-1000 were about 80% decrease risk to active disease at inclusion compared to income less than 500 AOR (0. 20; 95% CI (0.05,0.81). Patients with medium risk for malnutrition based on MUST score is about 2 times increased risk for active disease at inclusion compared to low risk AOR (2.55 ;95 % CI (1.01,6.42) and those with high risk were about 4 times at increased risk compared to low risk for malnutrition AOR (4.25CI (1.66,10.84) (Table 7).

Table 7: Bivariate and multivariate logistic regression of factors that affect active status of IBD Addis Ababa Ethiopia,2024

No	**Variable**	**Category**	**Total**	**Active disease status**		**COR(CI)**	**P value**	**AOR(CI)**	**P value**
				Yes	No				
1	Sex	Male	83	34	49	1.60(0.92,2.79)	**0.094**	1.52(0.80,2.89)	0.199
		Female	159	48	111	Ref			
2	Age in years	Mean ±SD				1.01(0.98,1.03)	0.394		
3	Marital status	Single	113	39	74	Ref	Ref	Ref	Ref
		Married	117	36	81	0.84(0.48,1.46)	**0.081**	0.74(0.0.34,1.49)	0.409
		Widowed	4	2	2	1.89(0.25,13.93)	**0.128**	3.14(0.23,42.90)	0.383
		Divorced	8	5	3	3.16(0.71,13.93)	0.680	2.39(0.42,13.33)	0.319
4	Place of residence	Rural	228	75	150	Ref	Ref	Ref	0.445
		Urban	14	7	7	0.49(0.16,1.44)	**0.197**	0.59(0.16,2.0)	
5	Level of education	No formal	18	7	11	Ref	Ref		
		Grade 1-8	30	13	17	1.20(0.36,3.95)	0.762		
		Grade 9-12	82	25	57	0.68(0.23,1.98)	0.490		
		College and above	112	37	75	0.77(0.27,2.16)	0.627		
6	Current occupation	No job	79	23	56	Ref	Ref		
		Employed	88	32	56	1.39(0.72,2.66)	0.322		
		Student	52	19	33	1.32(0.62,2.81)	0.460		
		Labour worker	21	8	13	1.49(0.54,4.09)	0.431		
		Retired	3	1	2	1.21(0.10,14.09)	0.875		
7	Income	500	19	9	10	Ref	Ref	Ref	Ref
		500 – 1000	36	7	29	0.26(0.07,0.90)	**0.035**	0.20(0.05.0.81)	**0.024**
		1001 – 5000	119	45	74	0.67(0.25,1.78)	**0.430**	0.80(0.25,2.50)	**0.706**
		>5000	68	21	47	0.49(0.17,1.40)	**0.186**	0.65(0.18,2.22)	0.491
8	Age at Diagnosis	Mean ±SD	28.01 ±10.83			1.00(0.98,1.03)	0.553		
9	Type of IBD	CD	190	60	130	Ref	**0.149**	Ref	0.181
		UC	52	22	30	1.58 (0.84,2.94)		1.71(0.77,3.77)	

10	Disease duration	Mean ±SD	4.06± 3.73			0.99(0.92,1.06)	0.776		
11	Current smoking	No Yes	239 3	80 2	159 1	Ref 3.97(0.3,44.49)	0.263		
12	Medication use for IBD at inclusion	None Yes	25 217	5 77	20 140	Ref 1.68(0.69,3.81)	Ref 0.258		
13	Hx surgery for IBD	No Yes	165 77	62 20	103 57	Ref 0.58(0.321.06)	**0.077**	**0.70(0.33,1.48)**	0.360
14	Hospitalizations due to IBD	No Yes	186 56	59 23	127 33	Ref 1.50(0.81,2.77)	**0.196**	**1.76(0.83,3.69)**	0.135
15	Chronic comorbidities	No Yes	223 19	122 9	101 10	Ref 1.15(0.43,3.04)	0.77		
16	Haemoglobin(mg/dl)	Mean ± SD	39.70 ±20.07			1.00	0.723		
17	Leucocytes/microliter)	Mean ± SD	6.27± 30.03			0.99	**0.244**	**0.99(0.98,1.00)**	0.501
18	Must score	Low Medium High	106 53 83	10 26 46	79 32 39	Ref 3.00(1.43,6.30) 4.69(2.43,9.04)	Ref **0.000** 0.000	Ref 2.54(1.01,6.42) 4.27(1.66,10.84)	Ref **0.047** **0.002**
19	SGA score	Grade A Grade B Grade C	117 65 60	27 28 27	86 37 37	Ref 2.52(1.25,4.63) 2.72(1.20,4.48)	Ref **0.005** 0.003	Ref 1.25(0.50,3.09) 1.04(0.30,3.52)	Ref 0.634 0.948
20	CRP	Normal Elevated	198 44	65 17	133 27	Ref 1.04(0.59,1.83)	Ref 0.873		
21	BMI	Underweight Normal Overweight Obesity	78 126 29 9	35 40 4 3	43 86 25 7	Ref 0.57(0.30,1.01) 0.19(0.059,0.60) 0.61(0.13,2.56)	Ref **0.060** **0.005** 0.512	Ref 0.92(0.36,2.33) 0.45(0.09,2.28) 1.15(0.15,8.65)	Ref 0.868 0.340 0.889

6. Discussion

Increased nutritional abnormality are commonly reported in IBD patients, particular among patients with active disease(63,64). While nutritional factor assessment such as BMI and vitamins have been studied in IBD patients(8,65), the role of other nutritional factors assessment methods such as SGA category and MUST score are poorly investigated in Sub-Saharan Africa including Ethiopia.

In this study, we aimed to characterize and measure the relationship between the nutritional profile of IBD patients and other sociodemographic and clinical factors which may influence the disease activity of IBD patients. We found that 82(33.88%) of our patients were active (defined as Harvey–Bradshaw index score >5 points for CD and, partial Mayo score >2 points for UC) at

inclusion. This finding is higher than other studies(16,66). How ever it is lower than other studies (67). This discrepancy is might be due to sample size, disease duration and diagnostic criteria used. 32% of patients already had surgery due to the IBD and 23% gave history of hospitalizations. Among those with previous surgery 26% had post OP active disease compared to 38% of patient with no prior surgery.

54.2% of our patients were found to at moderate (23.90%) or high risk (30.30%) of malnutrition based on MUST score. Using BMI, 32.23% of the patient are underweight with normal BMI (52.07% of the total). Interestingly, about 11.98% of patient are classified as overweight and 3.72% obese. Based on MUAC measurement about 21.9% of patient were classified as malnourished with 15.29% moderate and 6.61 % severe malnutrition. Using SGA, 51.65% of the patient are classified as malnourished ,24.79% severe and 26.86% moderate while only 48.35% are well nourished.

All the above finding highlight risk of and malnutrition is very prevalent among our IBD(CD) cohort of patients and is closely related to risk of having active Crohn's disease. All of the risk screening and nutritional assessment methods (tools) used above could correctly identify patients at risk and those with moderate or severe malnutrition. Moderate and severe malnutrition is associated with risk of clinically active IBD disease compared to those with normal nutritional status.

Early detection of IBD patients at risk of developing malnutrition is crucial due to its high prevalence and associated health risks (69). In our study, malnutrition was found to affect 51.65 of patients based on the SGA category and 47.93% based on BMI among all IBD patients. These rates are consistent with previous research done in China highlighting the high prevalence (49.5%) of malnutrition in this population (11). However, our findings exceed those reported in studies conducted in the USA (7.8%)(16), Spain (16%)(43), Turkey (9.9%)(70), and Romania 36.3% (71). On the other hand, some studies have reported an even higher burden of malnutrition, such as those conducted in China 59% (72) and India 52.6% (57). The observed discrepancies in malnutrition prevalence across studies attributed to several factors, including differences in the study populations included in each study (e.g., patients with active disease, those in remission, newly diagnosed patients, or hospitalized individuals), variations in sample sizes, and the use of different diagnostic criteria. Reduced oral intake, malabsorption, increased

nutrient losses from the gut, drug–nutrient interaction, increased requirements, increased lipid oxidation, reduced glucose oxidation, decreased diet-induced thermogenesis, and increased resting energy expenditure were the main mechanisms behind the high burden of malnutrition among IBD patients (73–75).

From as a general, we found that MUST score had a strong association with clinical activity in Crohn's disease (p value <0.001), ulcerative colitis (p value <0.014) and over all IBD patients (p value <0.001) in multivariable analysis after adjusting for covariates. This finding is supported by other studies done across worldwide (18,23,76–78). Studies have witnessed that Patients with active disease are more malnourished than those with quiescent disease (79).This might be due to generally more severe inflammation affects the bowel predisposing to reduced absorption of macro and micronutrients (77).

Again, in our study monthly income is significant predictor of having clinical features of active disease at inclusion in Crohn's disease (0.018), and over all IBD patients (0.024). To our knowledge this is the first study to show the direct association between them, however this finding supported the report that those with better income and socioeconomic status are at decreased risk to be active disease. Income as a predictor of developing active disease in inflammatory bowel disease (IBD), including Crohn's disease (CD) and ulcerative colitis (UC), aligns with findings from previous study (80). Research has demonstrated that socioeconomic status (SES), often measured by income, plays a crucial role in the onset and progression of IBD; studies have shown that lower income levels are associated with a higher risk of developing and experiencing more severe disease activity (81). This can be attributed to several factors, including reduced access to healthcare, lower quality of diet, higher levels of stress, and poorer living conditions, all of which can exacerbate inflammatory responses in the body (82,83). For instance, research by Sun et al. (2021) highlights the influence of lower socioeconomic status, the study concluded that lower income correlates with higher IBD symptom burden and reduced social participation, which can exacerbate health conditions (84).

Moreover, in our finding the inflammatory factor; CRP become significantly associated with active disease at inclusion those patients with ulcerative colitis. This finding was supported by different studies done (85,86). This might be due to C-reactive protein (CRP) recognizes

microbial and host lysolecithins to activate the complement system and is synthesized in the liver in response to interleukin-6 (IL-6). Moreover, high CRP modestly correlates with endoscopic UC (87) and reflects UC clinical activity (88). Levels of CRP increase dramatically in the presence of an acute-phase inflammation or infection. CRP concentrations also quickly decrease when the inflammation process is treated (89).

The perianal location of disease has also become significant predictor of disease activity after adjusting for other covariates among Crohn's disease. This finding was supported by studies (90) .This might be due to the fact that Crohn's disease is commonly complicated by a variety of perianal lesions. These lesions confront the treating physician with a challenging clinical entity that can result in morbidity for the patient if not approached with vigilance (90)

Additionally in univariate analysis those factors such as SGA category, BMI, history of IBD treatment exposure were significant predicts clinical activity of disease. SGA is a nutritional assessment tool that evaluates a patient's nutritional status based on their history and physical examination. While some studies have shown mixed results regarding its predictive value for clinical outcomes in IBD, it remains a significant factor in assessing nutritional risk, which can influence disease activity. A systematic review highlighted that SGA did not correlate strongly with clinical outcomes beyond hospital stay length, suggesting that while it may indicate nutritional status, its direct link to disease activity is less clear (91). BMI is often used as a simple measure of body composition and health. In the context of IBD, both underweight and obesity can complicate disease management. Studies have indicated that abnormal BMI can correlate with disease severity and treatment response. For instance, sarcopenic obesity—a condition where individuals have excess fat but low muscle mass—has been linked to poorer clinical outcomes in IBD patients, highlighting the importance of considering BMI in assessing disease activity (91,92).

Meanwhile in multivariable analysis after adjustment for covariates in at p value less than 0.05, those variables lost statistical significance. One common explanation is that these variables may have a confounding relationship with other stronger predictors of disease activity, reducing their apparent impact in the multivariate context. Additionally, the interaction between various factors can dilute the individual effect of variables during univariate analysis like BMI and SGA,

making them less significant in the adjusted model. Even if the finding could not show statistically significance, it should not be forgotten its clinically significant.

Strength and limitations

In our knowledge this the first study in this set up and, in our country, to assess the effects of nutritional factors in disease activity among IBD patients. The study done in two setting which would help us to generalize finding.

Saying this the study has undeniable shortcomings; because of its cross-sectional nature it is difficult to know which comes first between nutritional abnormality and disease activity of IBD patients. This study is prone to selection bias because it was conducted in health care set up only.

Conclusion

Malnutrition is prevalent among this cohort of IBD patients in treatment in two health institution is Addis Ababa, Ethiopia. Any of the standard nutrition assessment tools used in this study identified patients with malnutrition. Moderate and severe malnutrition is found to be associated with clinically active IBD disease compared to those with normal nutritional status.

Early comprehensive nutritional assessment of patients with IBD at diagnosis and at regular interval while on care and nutritional management of those with malnutrition is highly recommended in our clinical practice. The impact of such interventions on IBD disease activity and clinical outcomes like mortality and hospitalization is recommended as future research area.

Public Health Implications of the findings highlight the critical need for public health initiatives that address nutritional deficiencies and socioeconomic disparities among IBD patients. By prioritizing early detection of malnutrition and ensuring equitable access to healthcare, public health strategies can significantly reduce the burden of disease and improve outcomes in vulnerable populations.

Clinical Implications of the findings; Clinically, the study emphasizes the importance of routine nutritional assessments and the consideration of socioeconomic factors in managing IBD patients. Tailored interventions based on these assessments can lead to more effective disease management and better overall patient care.

Recommendations

For Hospitals:

Implement routine nutritional assessments, including MUST scores and SGA categories, for IBD patients to identify those at risk of malnutrition.

Regularly monitor ESR levels and disease location in CD patients to predict disease activity.

Prioritize access to nutritional support services for IBD patients, focusing on those with lower income or severe disease locations to improve overall patient outcomes.

For Health Professionals:

Use ESR and disease location as indicators to tailor treatment plans for UC and CD patients. Monitor nutritional status closely, particularly in patients with active disease, and provide targeted dietary interventions.

Educate patients on the importance of nutrition in managing IBD and the impact of socioeconomic factors on disease activity.

For the Ministry of Health:

Establish national guidelines for the early detection and management of malnutrition in IBD patients. Promote policies that improve access to healthcare for lower-income patients to reduce disparities in disease outcomes.

Develop programs that raise awareness about the role of nutrition and SES in IBD management, ensuring equitable healthcare access across different socioeconomic groups.

For Patients:

Engage in regular nutritional assessments and discuss any concerns with healthcare providers. Understand the role of SES in disease management and seek support services if needed.

Focus on maintaining a balanced diet and managing stress levels to help mitigate the impact of IBD.

For Researchers:

Conduct studies to explore the relationship between SES, nutritional factors, and disease activity in IBD. Focus on under-researched areas such as SGA categories and MUST scores in predicting disease outcomes.

Collaborate with healthcare institutions to share findings and develop comprehensive databases to support future research in IBD management.

7. REFERENCES

1. McDowell C, Farooq U, Haseeb M. Inflammatory bowel disease.[updated 2022 Jun 27]. StatPearls Internet Treasure Isl FL StatPearls Publ. 2023;

2. Danese S, Fiocchi C. Etiopathogenesis of inflammatory bowel diseases. World J Gastroenterol WJG. 2006;12(30):4807.

3. Mulder DJ, Noble AJ, Justinich CJ, Duffin JM. A tale of two diseases: the history of inflammatory bowel disease. J Crohns Colitis. 2014;8(5):341–8.

4. Alatab S, Sepanlou SG, Ikuta K, Vahedi H, Bisignano C, Safiri S, et al. The global, regional, and national burden of inflammatory bowel disease in 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet Gastroenterol Hepatol. 2020;5(1):17–30.

5. Desai D, Dhoble P. Rapidly changing epidemiology of inflammatory bowel disease: Time to gear up for the challenge before it is too late. Indian J Gastroenterol. 2024 Feb 1;43(1):15–7.

6. Dharni K, Singh A, Sharma S, Midha V, Kaur K, Mahajan R, et al. Trends of inflammatory bowel disease from the Global Burden of Disease Study (1990-2019). Indian J Gastroenterol Off J Indian Soc Gastroenterol. 2024 Feb;43(1):188–98.

7. Isaksson C. Urbanization, oxidative stress and inflammation: a question of evolving, acclimatizing or coping with urban environmental stress. Funct Ecol. 2015;29(7):913–23.

8. Einav L, Hirsch A, Ron Y, Cohen NA, Lahav S, Kornblum J, et al. Risk Factors for Malnutrition among IBD Patients. Nutrients. 2021 Nov;13(11):4098.

9. Singh A, Wall C, Levine A, Midha V, Mahajan R, Sood A. Nutritional screening and assessment in inflammatory bowel disease. Indian J Gastroenterol. 2022;1–18.

10. Scaldaferri F, Pizzoferrato M, Lopetuso LR, Musca T, Ingravalle F, Sicignano LL, et al. Nutrition and IBD: malnutrition and/or sarcopenia? A practical guide. Gastroenterol Res Pract. 2017;2017(1):8646495.

11. Liu J, Ge X, Ouyang C, Wang D, Zhang X, Liang J, et al. Prevalence of Malnutrition, Its Risk Factors, and the Use of Nutrition Support in Patients with Inflammatory Bowel Disease. Inflamm Bowel Dis. 2022 Jun 1;28(Supplement_2):S59–66.

12. Brant SR, Nguyen GC. Is there a gender difference in the prevalence of Crohn's disease or ulcerative colitis? Inflamm Bowel Dis. 2008 Oct 1;14(suppl_2):S2–3.

13. Tabibian A, Tabibian JH, Beckman LJ, Raffals LL, Papadakis KA, Kane SV. Predictors of Health-Related Quality of Life and Adherence in Crohn's Disease and Ulcerative Colitis: Implications for Clinical Management. Dig Dis Sci. 2015 May 1;60(5):1366–74.

14. Blumenstein I, Sonnenberg E. Sex- and gender-related differences in inflammatory bowel diseases. Front Gastroenterol [Internet]. 2023 Oct 3 [cited 2024 Sep 30];2. Available from: https://www.frontiersin.org/journals/gastroenterology/articles/10.3389/fgstr.2023.1199687/full

15. Berthon BS, Gibson PG, McElduff P, MacDonald-Wicks LK, Wood LG. Effects of short-term oral corticosteroid intake on dietary intake, body weight and body composition in adults with asthma - a randomized controlled trial. Clin Exp Allergy J Br Soc Allergy Clin Immunol. 2015 May;45(5):908–19.

16. Nguyen GC, Munsell M, Harris ML. Nationwide prevalence and prognostic significance of clinically diagnosable protein-calorie malnutrition in hospitalized inflammatory bowel disease patients. Inflamm Bowel Dis. 2008 Aug 1;14(8):1105–11.

17. Lomer MC, Cahill O, Baschali A, Partha Sarathy P, Sarantidou M, Mantzaris GJ, et al. A multicentre study of nutrition risk assessment in adult patients with inflammatory bowel disease attending outpatient clinics. Ann Nutr Metab. 2019;74(1):18–23.

18. Tocia C, Alexandrescu L, Dumitru A, Dumitru E. Assessment of nutritional status in correlation with quality of life and disease activity in Hospitalized Patients with Inflammatory Bowel Diseases. Age Years. 2019;40:19–22.

19. Saunders J, Smith T. Malnutrition: causes and consequences. Clin Med. 2010 Dec;10(6):624–7.

20. Baker R, Camosso-Stefinovic J, Gillies C, Shaw EJ, Cheater F, Flottorp S, et al. Tailored interventions to address determinants of practice. Cochrane Database Syst Rev. 2015 Apr 29;2015(4):CD005470.

21. Satsangi J, Silverberg M, Vermeire S, Colombel J. The Montreal classification of inflammatory bowel disease: controversies, consensus, and implications. Gut. 2006;55(6):749–53.

22. Silverberg MS, Satsangi J, Ahmad T, Arnott ID, Bernstein CN, Brant SR, et al. Toward an integrated clinical, molecular and serological classification of inflammatory bowel disease: report of a Working Party of the 2005 Montreal World Congress of Gastroenterology. Can J Gastroenterol Hepatol. 2005;19:5A-36A.

23. Spooren CEGM, Wintjens DSJ, De Jong MJ, Van Der Meulen-de Jong AE, Romberg-Camps MJ, Becx MC, et al. Risk of impaired nutritional status and flare occurrence in IBD outpatients. Dig Liver Dis. 2019 Sep;51(9):1265–9.

24. World Health Organization. Fact sheets-malnutrition. World Health Organ Internet. 2021;

25. Cederholm T, Barazzoni R, Austin P, Ballmer P, Biolo G, Bischoff SC, et al. ESPEN guidelines on definitions and terminology of clinical nutrition. Clin Nutr. 2017;36(1):49–64.

26. Shivashankar R, Tremaine WJ, Harmsen WS, Loftus Jr EV. Incidence and prevalence of Crohn's disease and ulcerative colitis in Olmsted County, Minnesota from 1970 through 2010. Clin Gastroenterol Hepatol. 2017;15(6):857–63.

27. Agrawal M, Christensen HS, Bøgsted M, Colombel JF, Jess T, Allin KH. The rising burden of inflammatory bowel disease in Denmark over two decades: a nationwide cohort study. Gastroenterology. 2022;163(6):1547–54.

28. Molodecky NA, Soon S, Rabi DM, Ghali WA, Ferris M, Chernoff G, et al. Increasing incidence and prevalence of the inflammatory bowel diseases with time, based on systematic review. Gastroenterology. 2012;142(1):46–54.

29. Ng SC, Tang W, Ching JY, Wong M, Chow CM, Hui A, et al. Incidence and phenotype of inflammatory bowel disease based on results from the Asia-pacific Crohn's and colitis epidemiology study. Gastroenterology. 2013;145(1):158–65.

30. Ng SC, Shi HY, Hamidi N, Underwood FE, Tang W, Benchimol EI, et al. Worldwide incidence and prevalence of inflammatory bowel disease in the 21st century: a systematic review of population-based studies. The Lancet. 2017;390(10114):2769–78.

31. Nerich V, Monnet E, Etienne A, Louafi S, Ramée C, Rican S, et al. Geographical variations of inflammatory bowel disease in France: a study based on national health insurance data. Inflamm Bowel Dis. 2006;12(3):218–26.

32. Khalili H, Huang ES, Ananthakrishnan AN, Higuchi L, Richter JM, Fuchs CS, et al. Geographical variation and incidence of inflammatory bowel disease among US women. Gut. 2012;61(12):1686–92.

33. Kappelman MD, Rifas–Shiman SL, Kleinman K, Ollendorf D, Bousvaros A, Grand RJ, et al. The prevalence and geographic distribution of Crohn's disease and ulcerative colitis in the United States. Clin Gastroenterol Hepatol. 2007;5(12):1424–9.

34. Sonnenberg A, McCarty DJ, Jacobsen SJ. Geographic variation of inflammatory bowel disease within the United States. Gastroenterology. 1991;100(1):143–9.

35. Ananthakrishnan AN, Khalili H, Higuchi LM, Bao Y, Korzenik JR, Giovannucci EL, et al. Higher predicted vitamin D status is associated with reduced risk of Crohn's disease. Gastroenterology. 2012;142(3):482–9.

36. Nerich V, Jantchou P, Boutron-Ruault M, Monnet E, Weill A, Vanbockstael V, et al. Low exposure to sunlight is a risk factor for Crohn's disease. Aliment Pharmacol Ther. 2011;33(8):940–5.

37. Munkholm P, Langholz E, Davidsen M, Binder V. Disease activity courses in a regional cohort of Crohn's disease patients. Scand J Gastroenterol. 1995;30(7):699–706.

38. Höie O, Wolters F, Riis L, Aamodt G, Solberg C, Bernklev T, et al. Ulcerative colitis: patient characteristics may predict 10-yr disease recurrence in a European-wide population-based cohort. Off J Am Coll Gastroenterol ACG. 2007;102(8):1692–701.

39. Feagins LA, Iqbal R, Spechler SJ. Case-control study of factors that trigger inflammatory bowel disease flares. World J Gastroenterol WJG. 2014;20(15):4329.

40. Dutta AK, Chacko A. Influence of environmental factors on the onset and course of inflammatory bowel disease. World J Gastroenterol. 2016;22(3):1088.

41. Hartman C, Eliakim R, Shamir R. Nutritional status and nutritional therapy in inflammatory bowel diseases. World J Gastroenterol WJG. 2009;15(21):2570.

42. Mijač DD, Janković GL, Jorga J, Krstić MN. Nutritional status in patients with active inflammatory bowel disease: prevalence of malnutrition and methods for routine nutritional assessment. Eur J Intern Med. 2010;21(4):315–9.

43. Casanova MJ, Chaparro M, Molina B, Merino O, Batanero R, Dueñas-Sadornil C, et al. Prevalence of Malnutrition and Nutritional Characteristics of Patients With Inflammatory Bowel Disease. J Crohns Colitis. 2017 Dec 4;11(12):1430–9.

44. Gerasimidis K, McGrogan P, Edwards C. The aetiology and impact of malnutrition in paediatric inflammatory bowel disease. J Hum Nutr Diet. 2011;24(4):313–26.

45. White JV, Guenter P, Jensen G, Malone A, Schofield M, Force AMT, et al. Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). J Acad Nutr Diet. 2012;112(5):730–8.

46. Bamba S, Sasaki M, Takaoka A, Takahashi K, Imaeda H, Nishida A, et al. Sarcopenia is a predictive factor for intestinal resection in admitted patients with Crohn's disease. PLoS One. 2017;12(6):e0180036.

47. Zhang T, Ding C, Xie T, Yang J, Dai X, Lv T, et al. Skeletal muscle depletion correlates with disease activity in ulcerative colitis and is reversed after colectomy. Clin Nutr. 2017;36(6):1586–92.

48. Pedersen M, Cromwell J, Nau P. Sarcopenia is a predictor of surgical morbidity in inflammatory bowel disease. Inflamm Bowel Dis. 2017;23(10):1867–72.

49. Zhang T, Cao L, Cao T, Yang J, Gong J, Zhu W, et al. Prevalence of sarcopenia and its impact on postoperative outcome in patients with Crohn's disease undergoing bowel resection. J Parenter Enter Nutr. 2017;41(4):592–600.

50. Norman K, Kirchner H, Lochs H, Pirlich M. Malnutrition affects quality of life in gastroenterology patients. World J Gastroenterol WJG. 2006;12(21):3380.

51. Rocha R, Santana GO, Almeida N, Lyra AC. Analysis of fat and muscle mass in patients with inflammatory bowel disease during remission and active phase. Br J Nutr. 2008;101(5):676–9.

52. Benjamin J, Makharia G, Ahuja V, Joshi YK. Body composition in Indian patients with Crohn's disease during active and remission phase. Trop Gastroenterol. 2012;32(4):285–91.

53. Ripoli J, Miszputen SJ, Ambrogini Jr O, Carvalho L de. Nutritional follow-up of patients with ulcerative colitis during periods of intestinal inflammatory activity and remission. Arq Gastroenterol. 2010;47:49–55.

54. Geerling BJ, Badart-Smook A, Stockbrügger RW, Brummer R. Comprehensive nutritional status in patients with long-standing Crohn disease currently in remission. Am J Clin Nutr. 1998;67(5):919–26.

55. Valentini L, Schaper L, Buning C, Hengstermann S, Koernicke T, Tillinger W, et al. Malnutrition and impaired muscle strength in patients with Crohn's disease and ulcerative colitis in remission. Nutrition. 2008;24(7–8):694–702.

56. Geerling B, Badart-Smook A, Stockbrügger R, Brummer RJ. Comprehensive nutritional status in recently diagnosed patients with inflammatory bowel disease compared with population controls. Eur J Clin Nutr. 2000;54(6):514–21.

57. Benjamin J, Makharia GK, Kalaivani M, Joshi YK. Nutritional status of patients with Crohn's disease. Indian J Gastroenterol. 2008;27(5):195–200.

58. Weekes CE, Elia M, Emery PW. The development, validation and reliability of a nutrition screening tool based on the recommendations of the British Association for Parenteral and Enteral Nutrition (BAPEN). Clin Nutr. 2004;23(5):1104–12.

59. Lim SL, Lin XH, Daniels L. Seven-point subjective global assessment is more time sensitive than conventional subjective global assessment in detecting nutrition changes. J Parenter Enter Nutr. 2016;40(7):966–72.

60. Vermeire S, Schreiber S, Sandborn WJ, Dubois C, Rutgeerts P. Correlation between the Crohn's disease activity and Harvey–Bradshaw indices in assessing Crohn's disease severity. Clin Gastroenterol Hepatol. 2010;8(4):357–63.

61. Lewis JD, Chuai S, Nessel L, Lichtenstein GR, Aberra FN, Ellenberg JH. Use of the noninvasive components of the Mayo score to assess clinical response in ulcerative colitis. Inflamm Bowel Dis. 2008;14(12):1660–6.

62. MUAC-Classification-https://www.fantaproject.org/sites/default/files/resources/Ethiopia--2008.pdf. Available from: https://www.fantaproject.org/sites/default/files/resources/

63. B F, N K, T R, S K. Nutritional status in hospitalized patients in the department of gastroenterohepatology. - Abstract - Europe PMC. [cited 2024 Aug 21]; Available from: https://europepmc.org/article/med/21937384

64. Gheorghe C, Pascu O, Iacob R, Vadan R, Iacob S, Goldis A, et al. Nutritional risk screening and prevalence of malnutrition on admission to gastroenterology departments: a multicentric study. Chir Bucur. 2013;108(4):535–41.

65. Vagianos K, Bector S, McConnell J, Bernstein CN. Nutrition Assessment of Patients With Inflammatory Bowel Disease. J Parenter Enter Nutr. 2007;31(4):311–9.

66. Calvo EG, Gil MD, Jiménez BV, Salazar LF, Elisa GC, Miguel DG. Prevalence and factors associated with poor sleep quality in inflammatory bowel disease outpatients. Rev Espanola Enfermedades Dig. 2021;113:512–8.

67. Ali T, Madhoun MF, Orr WC, Rubin DT. Assessment of the Relationship Between Quality of Sleep and Disease Activity in Inflammatory Bowel Disease Patients. Inflamm Bowel Dis. 2013 Oct 1;19(11):2440–3.

68. Chandrasinghe P. Surgical Management of Small Bowel Crohn's Disease. Front Surg [Internet]. 2022 Apr 15 [cited 2024 Oct 14];9. Available from: https://www.frontiersin.org/journals/surgery/articles/10.3389/fsurg.2022.759668/full

69. Balestrieri P, Ribolsi M, Guarino MPL, Emerenziani S, Altomare A, Cicala M. Nutritional Aspects in Inflammatory Bowel Diseases. Nutrients [Internet]. 2020 Feb [cited 2024 Oct 13];12(2). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7071234/

70. Ünal NG, Oruç N, Tomey O, Ömer Özütemiz A. Malnutrition and sarcopenia are prevalent among inflammatory bowel disease patients with clinical remission. Eur J Gastroenterol Hepatol. 2021 Nov;33(11):1367.

71. Ciocîrlan M, Ciocîrlan M, Iacob R, Tanțău A, Gheorghe L, Gheorghe C, et al. Malnutrition Prevalence in Newly Diagnosed Patients with Inflammatory Bowel Disease - Data from the National Romanian Database. J Gastrointest Liver Dis JGLD. 2019 Jun 1;28:163–8.

72. Cao Q, Huang YH, Jiang M, Dai C. The prevalence and risk factors of psychological disorders, malnutrition and quality of life in IBD patients. Scand J Gastroenterol. 2019 Dec 2;54(12):1458–66.

73. Goh J, O'Morain CA. Nutrition and adult inflammatory bowel disease. [cited 2024 Aug 21]; Available from: https://onlinelibrary.wiley.com/doi/10.1046/j.1365-2036.2003.01482.x

74. Cabré E, Gassull MA. Nutrition in inflammatory bowel disease: impact on disease and therapy. Curr Opin Gastroenterol [Internet]. 2001;17(4). Available from: https://journals.lww.com/co-gastroenterology/fulltext/2001/07000/nutrition_in_inflammatory_bowel_disease__impact_on.8.aspx

75. Han PD, Burke A, Baldassano RN, Rombeau JL, Lichtenstein GR. Nutrition and inflammatory bowel disease. Gastroenterol Clin North Am. 1999;28(2):423–43.

76. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z, An ad hoc ESPEN Working Group. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr. 2003;22(3):321–36.

77. Rahman A, Williams P, Sandhu A, Mosli M. Malnutrition Universal Screening Tool (MUST) scores predicts disease activity in patients with Crohn's disease. Can J Nutr. 2016;1:1–5.

78. Takaoka A, Sasaki M, Kurihara M, Iwakawa H, Inoue M, Bamba S, et al. Comparison of energy metabolism and nutritional status of hospitalized patients with Crohn's disease and those with ulcerative colitis. J Clin Biochem Nutr. 2015;56(3):208–14.

79. Uc G, A S. Malnutrition in inflammatory bowel disease patients in northern India: frequency and factors influencing its development. Trop Gastroenterol. 2010 Jun 11;29(2):95–7.

80. Kostić M, Djakovic L, Šujić R, Godman B, Janković SM. Inflammatory Bowel Diseases (Crohn´s Disease and Ulcerative Colitis): Cost of Treatment in Serbia and the Implications. Appl Health Econ Health Policy. 2017 Feb 1;15(1):85–93.

81. Ganz ML, Sugarman R, Wang R, Hansen BB, Håkan-Bloch J. The Economic and Health-related Impact of Crohn's Disease in the United States: Evidence from a Nationally Representative Survey. Inflamm Bowel Dis. 2016 May 1;22(5):1032–41.

82. Walker C, Allamneni C, Orr J, Yun H, Fitzmorris P, Xie F, et al. Socioeconomic Status and Race are both Independently associated with Increased Hospitalization Rate among Crohn's Disease Patients. Sci Rep. 2018 Mar 5;8(1):4028.

83. Wardle RA, Wardle AJ, Charadva C, Ghosh S, Moran GW. Literature review: impacts of socioeconomic status on the risk of inflammatory bowel disease and its outcomes. Eur J Gastroenterol Hepatol. 2017 Aug;29(8):879.

84. Su S, Marrie RA, Bernstein CN. Factors Associated With Social Participation in Persons Living With Inflammatory Bowel Disease. J Can Assoc Gastroenterol. 2021 Jul 21;5(2):59–67.

85. Yoon JY, Park SJ, Hong SP, Kim TI, Kim WH, Cheon JH. Correlations of C-reactive Protein Levels and Erythrocyte Sedimentation Rates with Endoscopic Activity Indices in Patients with Ulcerative Colitis. Dig Dis Sci. 2014 Apr 1;59(4):829–37.

86. Karoui S, Ouerdiane S, Serghini M, Jomni T, Kallel L, Fekih M, et al. Correlation between levels of C-reactive protein and clinical activity in Crohn's disease. Dig Liver Dis. 2007 Nov 1;39(11):1006–10.

87. Iwańczak B, Ruczka M, Matusiewicz M, Pytrus T, Matusiewicz K, Krzesiek E. Correlation between biomarkers (calprotectin, seromucoid, metalloproteinase-3 and CRP) and clinical and endoscopic activity of ulcerative colitis in children. Adv Med Sci. 2020 Sep 1;65(2):259–64.

88. Karoui S, Laz S, Serghini M, Bibani N, Boubaker J, Filali A. Correlation of C-Reactive Protein with Clinical and Endoscopic Activity in Patients with Ulcerative Colitis. Dig Dis Sci. 2011 Jun 1;56(6):1801–5.

89. Vermeire S, Van Assche G, Rutgeerts P. C-Reactive Protein as a Marker for Inflammatory Bowel Disease. Inflamm Bowel Dis. 2004 Sep 1;10(5):661–5.

90. Safar B, Sands D. Perianal Crohn's Disease. Clin Colon Rectal Surg. 2007 Nov;20(4):282–93.

91. Li S, Ney M, Eslamparast T, Vandermeer B, Ismond KP, Kroeker K, et al. Systematic review of nutrition screening and assessment in inflammatory bowel disease. World J Gastroenterol. 2019 Jul 28;25(28):3823.

92. Wintjens D, Bergey F, Saccenti E, Jeuring S, Heuvel T van den, Romberg-Camps M, et al. Disease Activity Patterns of Crohn's Disease in the First Ten Years After Diagnosis in the Population-based IBD South Limburg Cohort. J Crohns Colitis. 2020 Aug 26;15(3):391.

8. APPENDICES

Appendix 1: English version of the questionnaire

Questionnaire

No	**I. Socio demographic characteristics**	Response classification	Remark
1.	Card number	_____	
2.	Sex of the respondents	1. Male 2. Female	
3.	Age (years)	…….	
4.	What is your marital status?	1.Married 2.Single 3. Widowed 4. separated 5. Divorced	
5.	Where is your place of residence?	1. Urban 2. Rural	
6.	What is your level of education?	1. Cannot read and write	

		2. Read and write 3. Grade 1-8 4. Grade 9-12 5. College and above	
7.	What is your current occupation?	1. Student 2. Government employee 3. Private enterprise employee 4. Daily laborer 5. Merchant 6. Housewife 7. No job 8. Other specify…….	
8.	How much income you earn monthly? (Ethiopian Birr)	1. <500 2. 500 – 1000 3. 1001 – 5000 4. >5000	
II. Patient characteristics			
9.	Age at Diagnosis of IBD (in years)	_____	
10.	Type of IBD	1. Crohns disease 2. Ulcerative colitis	
11.	If 1 to no. 9, Disease location (CD)	1. Ileal 2. Colonic 3. Ileocolonic	
12.	If 1 to no. 9, Disease behaviour (CD)	1. non-stricturing, non-penetrating 2. stricturing 3. penetrating	
13.	If 1 to no. 9, Current activity of the disease according to the Harvey-Bradshaw Index (HBI)/ CDAI	1. In remission 2. Mild disease 3. Moderate disease 4. Severe disease	
14.	If 2 to no. 9, Disease extent (UC)	1. proctitis,, 2. left-sided, 3. pancolitis,	
15.	If 2 to no. 9, Severity of Ulcerative colitis according to Partial Mayo Scoring Index?	1. S0 In remission 2. S1 Mild UC 3. S2 Moderate UC 4. Severe UC	
16.	Disease duration at inclusion (years)	_____	
17.	Active disease at inclusion	1. Yes 2. No	
18.	Medication use at inclusion for IBD	1. No medication 2. 5-ASA 3 Azathioprine 4 Methotrexate	

		5 Biologics 6 Steroid 7 Combinations of medications for IBD	
19.	Current smoking at inclusion	1. Yes 2. No	
20.	Previous surgery for IBD	1. Yes 2. No	
21.	History of hospitalizations due to IBD	1. Yes 2. No	
22.	number of hospitalizations due to IBD		
23.	chronic comorbidities	1. Yes 2. No	
24.	chronic comorbidities	1 psychiatric diseases 2 DM 3 . HTN 4 . Stroke	
25.	The use of nutritional supplements and vitamins	1. Yes 2. No	
III. Nutritional Status assessment			
26.	Height (cm)	_____	
27.	Weight(kg)	_____	
28.	BMI Kg/m2	_____	
29.	MUAC	_____	
30.	MUST Score	_____	
31.	MUST Score Category	1. Low risk for malnutrition (Score 0) 2. Medium risk for malnutrition (Score 1) 3. High risk for malnutrition (Score ≥ 2)	
32.	SGA Category	1. grade A, well nourished 2. grade B, moderately malnourished 3. grade C, severely malnourished	
III. Biochemical parameters			
33.	Haemoglobin(mg/dl)	_____	
34.	Leucocytes/microliter)	_____	
35.	Albumin(mg/dl)	_____	
36.	C-reactive protein	_____	
37.	ESR		

Partial Mayo Scoring Index for Ulcerative Colitis Activity

1. Stool Frequency (based on the past 3 days)
   Normal number of stools = 0
   1-2 stools more than normal = 1
   3-4 stools more than normal= 2
   5 or more stools more than normal = 3
2. Rectal Bleeding (based on the past 3 days)
   No blood seen = 0
   Streaks of blood with stool less than half the time = 1
   Obvious blood with stool most of the time = 2
   Blood alone passed = 3
3. Physician's Global Assessment
   Normal = 0 Mild disease = 1
   Moderate disease= 2 Severe diseases = 3
   Total Partial Mayo Index Score

Remission = 0-1 Mild Disease = 2-4 Moderate Disease = 5-6 Severe Disease =7-9

Lewis JD et al, Use of the noninvasive components of the Mayo score to assess clinical response in ulcerative colitis. Inflamm Bowel Dis. 2008 Dec;14(12):1660-6.

Harvey Bradshaw Index Assessment for Crohn's Disease Activity

1. General Well-being

Very well = 0 Slightly below Par = 1 Poor = 2 Very Poor = 3
Terrible = 4

2. Abdominal Pain

None = 0 Mild = 1 Moderate = 2 Severe = 3

3. Number of Liquid or Soft Stools per day
4. Additional Manifestations

None = 0 Arthalgia = 1 Uveitis = 1 Erythema Nodosum = 1
Aphthous ulcer = 1 Pyoderma gangrenosum = 1 Anal Fissure = 1
New Fistula = 1 Abscess = 1

Total Harvey Bradshaw

Remission = <5
Mild Disease = 5-7
Moderate Disease = 8-16
Severe Disease >16

Vermeire et al, Correlation Between the Crohn's Disease Activity and Harvey–Bradshaw Indices in Assessing Crohn's Disease Severity, *Clinical gastroenterology and hepatology* 2010;8:357–363

እኔ ዶ/ር ዝናቡ ደሳለኝ እባላለሁ ፤ በአዲስ አበባ ዩኒቨርስቲ በጥቁር አንበሳ ሆስፒታል የአንጀት ፣ የጨጓራና የጉበት ሰብ እስፔሻሊቲ የመጨረሻ ዓመት ተማሪ ነኝ፡፡

የመመረቂያ ጽሁፌን የሚሠራው የተመጣጠነ ምግብ እጥረት አደጋን መመርመር እና አይቢዲ በሽተኞች መካከል ግምገማ ላይ ሲሆን የጥናቱ ዓላማ አይቢዲ በሽታ ባለባቸው ሰዎች ላይ ያለው የተመጣጠነ የምግብ እጥረት አደጋ ምን ያህል እንደሆነ መመርመር እና ከአይቢዲ በሽታ መባባስ ጋር ያለውን ተያያዥነት ማጥናት ነው፡፡

ጥቅሞች እና ጉዳቶች

ምንም እንኳን ለእርስዎ ምንም አይነት ቀጥተኛ ጥቅም ላይኖር ይችላል, የእርስዎ ተሳትፎ ስለ ተመጣጠነ የምግብ እጥረት አደጋን እና አይቢዲ ላይ ያለንን ግንዛቤ ለማሳደግ አስተዋፅኦ ሊያደርግ ይችላል, ይህም ሥር የሰደደ የአይቢዲ በሽታ ላለባቸው ግለሰቦች የተሻሻሉ የምርመራ እና የሕክምና ዘዴዎችን ያመጣል.፡፡ በመረጃ አሰባሰብ ሂደት ውስጥ አንዳንድ ምቾት ወይም ምቾት ማጣት ሊከሰት ይችላል፡፡

እርስዎ ፈቃደኛ ከሆኑ ለዚህ ጥናት ግብዓት ለሚሆኑ ጥያቄዎች በሙሉ ፈቃደኝነት መልስ እንዲሰጡኝ እየጠየኩ መረጃው በሚስጢር የሚያዝና ለሌላ አገልግሎት የማይውል መሆኑን እንዲሁም ለጥያቄዎች የሚሰጡት ምላሽ የሚያገኙት የህክምና አገልግሎት ላይ ምንም አይነት ተጽእኖ እንደማይፈጥር አረጋግጥልዎታለሁ፡፡. ከላይ የተሰጠውን ማብራሪያ የተረዱ ከሆነ እና በጥናቱ ለመሳተፍ ያለምንም ተጽእኖ ፈቃደኛ ከሆኑ ከታች በተሰጠው ቦታ ፊርማዎትን በማስቀመጥ ፈቃደኛነትዎን ያረጋግጡልኝ፡፡

የተሳታፊ ፊርማ …….

የመረጃ ሰብሳቢ ስምና ፊርማ……..

ቀን፡- ……

ASSURANCE OF PRINCIPAL INVESTIGATOR

As the Principal Investigator I assure that the research will adhere to all ethical guidelines, with necessary approvals obtained, and I will take full responsibility for the design, execution, and reporting. Data will be securely managed, confidentiality maintained, and all funds will be handled in compliance with regulations. The project will be completed on schedule with timely submissions of required reports, and I will ensure adherence to all legal and regulatory requirements.

As the principal investigator

Name of the PI D/r Zinabu Desalegn (MD .GI and hepatology fellow)

Date. _____ Signature _____