ADDIS ABABA UNIVERSITY
SCHOOL OF MEDICINE, COLLEGE OF HEALTH SCIENCES

Proportion and predictors of suboptimal colonic preparation among patients who undergone elective colonoscopy at a tertiary care center, Addis Ababa, Ethiopia: a prospective cross-sectional study

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Proportion and predictors of suboptimal colonic preparation among patients who undergone elective colonoscopy at a tertiary care center, Addis Ababa, Ethiopia: a prospective cross-sectional study.

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Abstract

Background:colonoscopy is an important diagnostic and therapeutic tool for various conditions affecting the colon, rectum and terminal ileum. Bowel preparation is one of the key quality indicators among others. Suboptimal bowel preparation will significantly affect safety and diagnostic yield of the procedure. To date there is no adequate information regarding the quality and outcome of colposcopy preparation as well as predictors of sub optimal preparation in our set up.

Aim: -The main objective of this study wastodetermine the proportionand predictors of suboptimal bowel preparation among patients who undergone elective colonoscopy at TASH.

Methods: -A prospective cross-sectional study was conducted on 282 elective colonoscopies done at TASH from March, 2023 to August 30, 2023 G.C.After informed consent,interviewer administered structured questioner was used to collect data by a trained interviewer. The edoscopist assessed the quality of preparation using Aronchick scale. The collected data was cleaned, checked for completeness, compiled, entered in to Epidata andexported to SPSS 26 for analysis. Bivariate and multivariable logistic regression analysis was conducted to identify determinants of suboptimal colonic preparation. P value< 0.05 was taken as significant.

Result:-Suboptimal colonic preparation was observed in 45% of the cases with 15.2% procedure cancelation rate attributable to inadequate colonic preparation. On multivariate analysis, age more than 60 years and non-adherence to the recommended dose of castor oil were predictors of suboptimal colonic preparation while short telephone call a day before the start of preparation and taking anti diabetic medication where negative predictors of suboptimal colonic preparation.

Conclusion: -This study revealed unacceptably high proportion of suboptimal bowel preparation and procedure cancellation rate. Clinical variables independently associated with quality of preparation include; old age, adherence to preparation regimen, anti-diabetic medication intake and telephone counseling. Therefore intervention targeting these predictors should be designed to improve quality of pre –colonosopic bowel preparation.

Acknowledgment

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TABLE OF CONTENT

Table of Contents Page

List of tables and figures

List of tables

List of figures

Abbreviations

AAU	Addis Ababa University
ADR	Adenoma detection rate
AOR	Adjusted odds ratio
BMI	Body mass index
CHS	College of health science
CI	Confidence interval
CIR	Cecal intubation rate
CRC	Colorectal cancer
DM	Diabetes mellitus
GI	Gastrointestinal
HTN	Hypertension
IBP	Inadequate bowel preparation
NSAID	Non-steroidal anti-inflammatory drug
OR	Odds ratio
SOM	School of medicine
SSRI	Selective serotonin reuptake inhibitors
TASH	TikurAnbessa Specialized Hospital
TCA	Tri cyclic antidepressants

Introduction

1.1 Background

Colonoscopy is an important procedure used in the diagnosis and intervention of various disease conditions involving the rectum, colon and terminal ileum. Currently it's used as a standard of care for the screening of colorectal cancer and diagnosis and treatment of numerous other colorectal disorders.(1)

Safety and diagnostic yield of colonoscopy done for any indication is closely related to the adequacy of preprocedure bowel cleansing. It is recommended to achieve adequate bowel preparation sufficient enough to visualize colonic mucosa to detect a lesion in at least 85% of the times in a given setup, however various studies showed colonic preparation to be suboptimal in more than quarter of the cases.(2)

Among different bowel preparation quality scales, the most widely used and validated scales include the Aronchick Scale (ACS), the Boston Bowel Preparation Scale (BBPS), and the Ottawa Bowel Preparation Scale (OBPS).(3)

Suboptimal colonic preparation can result in prolonged procedure time,Aborted examinations and short interval between surveillance colonoscopies to minimize risk of missed adenomas. This in turn will result in inappropriately increased service related cost. (4)

Suboptimal colonic preparation is not an issue of cost and yield only, itis also a safety issue associated with high rate of procedure related complications. Poor preparation is among the various predictors of immediate procedure related complications including sever pain, distention, perforation and bleeding.(5)

In this study we have looked in to the magnitude of suboptimal colonic preparation and identified factors associated to it among patients who underwent elective colonoscopy atTikurAnbessa specialized comprehensive hospital (TASH); a tertiary care center.

1.2 STATEMENT OF THE PROBLEM

Despite ample evidences on the impact of optimal colonic preparation on safety and diagnostic yield, it remains an important challenge in the practice of diagnostic and therapeutic colonoscopy. Although The rate of suboptimal bowel cleansing is recommended not to exceed 15%, Multiple studies have shown nearly 25% of cases of bowel preparation to be suboptimal.(2)

Inadequate bowel preparation has a detrimental effect on all aspects of the colonoscopy procedure, most importantly on its accuracy. It has been associated with; low adenoma detection rate (ADR), lower cecal intubation rate (CIR), unsatisfactory patient experience, prolonged hospital stay, short surveillance interval and increased overall cost.(6)

There are several potential predictors of suboptimal bowel preparations which where demonstrated in multiple studies. These predictive factors include the following among others; being overweight, male sex, a high body mass index (BMI), older age, previous colorectal surgery and comorbidities including cirrhosis; Parkinson disease and diabetes mellitus(DM) .(7)

Although much is known about the magnitude and predictors of suboptimal bowel preparation and its implication on the safety and efficacy of colonoscopy, it has not been studied in our set up. Another important gap is, most studies done on bowel preparation in different parts of the world use different bow cleansing agents (Like Polyethylene glycol-electrolyte solution) than we use in Ethiopian context (where castor oil and Bisacodyl are the widely used medications).

This study is intended to address the above mentioned gaps so that the data generated will help to address potential limitations and improve overall colonoscopy service quality in Ethiopia.

1.3 Significance of the study

The current medical practice of Ethiopia includes colonoscopy as an important diagnostic and therapeutic tool for various medical conditions affecting the large bowel and terminal ileum in a number of public and private hospitals.

It has been known that quality of bowel cleansing is independently related to the safety and diagnostic yield of colonoscopy. But there was no data in our set up that helps to predict patients who are likely to have suboptimal colonic preparation using the routine preparation regimen.

The findings of this study will address the information gap we have both on magnitude as well as predictors of suboptimal bowel preparation.

The finding of the study will help;

- To identify group of patients who are likely to have Poor colonic preparation so that a due emphasis can be given during counseling or alternative preparation regimen can be used.
- To identify and act on correctable causes of poor colonic preparation
- As an input for quality improvement project
- As a baseline data to plan for subsequent interventional studies targeting on developing optimal, locally applicable preparation protocol.

2 LITERATURE REVIEW

2.1 Introduction

Colonoscopy and flexible sigmoidoscopy has revolutionized the science and practice of various Gastrointestinal (GI) disorders, as it allows diagnosis of various malignant and nonmalignant lower GI conditions in addition to its role as a therapeutic armamentarium. (8)

Since its first introduction in 1969, colonoscopy has been accepted as a powerful screening tool for the early detection of colorectal cancer (CRC). Also, it plays an important role in the prevention of CRC through the diagnosis and removal of adenomatous polyps (premalignant lesions of CRC). Colonoscopy allows for greater diagnostic specificity and sensitivity compared with other types of examinations, such as the stool occult blood test, barium enema, and computed tomography colonography.(9)

One major drawback of colonoscopy is the significant variation on the practice and outcome among individuals and institutions; this mandates development of a universally agreed upon quality indicators. Adequacy of Colonic preparation is one of the quality indicators in addition to Adenoma detection rate, cecal intubation rate and withdrawal time.(10)

The Aronchick Scale is the most commonly used validated bowel preparation quality scales in clinical trials and clinical practice among others. It assess the total colonic mucosal surface covered by fluid or stool, without scoring for separate colon segments, quality will be graded as excellent, good, fair , poor and inadequate.(3)

2.2 Impact of suboptimal bowel preparation

Colonoscopy is generally safe, widely used procedure. However, if appropriate caution is not made during the procedure it could have Gastrointestinal and non-gastrointestinal complications including; bleeding, perforation, and myocardial infarction(1).

Colonic preparation is an important quality indicator in colonosopic procedures lack of which will result in a number of Adverse consequence including ; lower ADR, longer procedural time, lower CIR, increased electro cautery risk, and shorter intervals between examinations.(2)

A study done on Predictive factors for colonoscopy complications by Annie OO Chan et al on 6196 colonoscopies found out 73 cases of incomplete colonoscopies of which 25% was because of inadequate colonic preparation. In this study there were 48 cases (7.7 per 1000 procedures) of immediate colonoscopy related complications (pain, distention and perforation). Inadequate bowel preparation and incomplete colonoscopy were the significant predictors for immediate colonoscopy- related complications adjusted odds ratio (AOR=3.5 and 6.2, respectively; both were $P<0.05$).(5)

Successful cecal intubation is an important quality indictor which can be affected by poor colonic preparation. A study done on 2,050 colonoscopies performed by GI trainees in Korea found out failed cecal intubation in 330 cases (16.1%). On multivariate analysis the three predictors of cecal intubation failure where; low BMI, inadequate bowel preparation, and previous stomach surgery: with cecal intubation failure: 1.9 times, 2.0 times, and 2.2 times more likely, respectively. (11)

A study done by Gavin C. et al on 93,004 colonoscopies with adequate documentation showed, rate of adequate colonic preparation to be 76.9%. On multivariate analysis, preparation adequacy was associated with colonic lesion detection, odds ratio (OR) 1.21: 95% CI [1.16, 1.25].Adequate preparation demonstrated a closer association with identification of smaller lesions (polyps ≤9 mm), OR 1.23: 95% CI [1.19, 1.28], while its impact on larger polyps is insignificant(12). A similar conclusion was made by a Meta-Analysis of the Effect of Bowel

Preparation on Adenoma Detection: Early Adenomas Affected Stronger than Advanced Adenomas.(13)

Adenomas and high risk lesions can be missed when colonoscopy is done with sub-optimal bowel preparation. A study done by Reena V. et al on the Prevalence of missed adenomas in patients with inadequate bowel preparation on screening colonoscopy found the following results: of the 373 patients included in the study with inadequate colonic preparation ADR was 25.7% of which 12.9% has high risk features. On repeat colonoscopy with adequate preparation, 33.8% had at least one adenoma of which 18% has high risk feature. This shows a calculated miss rate of 47.9 % attributable to quality of bowel preparation.(14)

2.3 Magnitude and Predictors of suboptimal bowel preparation

There is an organized data on various factors that predict poor colonic preparation from studies done in different parts of the world.

Health literacy is an important predictor of colonic preparation adequacy. A Study performed o by Douglas L. Nguyen and Mark Wieland on 300 patients who underwent routine outpatient colonoscopy found out rate of inadequate preparation to be 15%. On multivariate model the predictors of poor colonic preparation were: interpreter requirement, Medicaid insurance, single status, and having more than 8 active prescription medications.(15)

Socioeconomic and Other Predictors of Colonoscopy Preparation Quality, a study by Benjamin Lebwohl and his colleagues; about 88% of 12,430 patients had documented bowel preparation quality of which 19% were inadequately prepared. Variables independently associated with suboptimal preparation included increased age (OR per 10 years 1.09, 95% CI1.05–1.14), male gender (OR 1.44, 95% CI 1.31–1.59), inpatient status (OR 1.51, 95% CI 1.26–1.80), and time of examination after the median value of 11:00 AM (OR 1.89,95% CI 1.71–2.09). Marital status was protective against a suboptimal preparation (OR 0.89, 95% CI 0.80–0.98).(16)

A multivariate analysis of various Demographic, anthropometric, and drug consumption data done by Amir Sadeghi et al on his study of Predictive factors of inadequate bowel preparation for elective colonoscopy showed bowl preparation quality to be independently associated with ; age , body habitus (BMI and Abdominal circumference), low fruit consumption , history of smoking and drugs (NSAID and SSRI). The study included 2,476 patients who undergone elective colonoscopy, of which 31.8% had sub optimal bowel preparation which was independently associated with the above mentioned variables in a multivariate analysis (17). Impact of Obesity as an independent predictor of inadequate bowel preparation at colonoscopy was also demonstrated in other study performed on 1588 colonoscopies with 25.3% suboptimal bowel preparation rate.(18)

Among 524 in patient colonoscopies, 22.3 % had inadequate preparation, which was independently associated with the following potential predictors: lower income (OR 1.11; 95 % CI 1.04, 1.22), opiate or tricyclic antidepressant (TCA) use (OR 1.55; 0.98, 2.46), and afternoon colonoscopy (OR 1.66; 1.07, 2.59); as well as American Society of Anesthesiologists (ASA) class C3 (OR 1.15; 1.05, 1.25) and symptoms of nausea/vomiting (OR 1.14; 1.04, 1.25). (19)

Volume of fluid consumption during preparation for colonoscopy as possible determinant of bowel preparation adequacy was proven by Yuri Gorelika et al.in this study the rate of IBP was 19.4% among 1, 172 participants. Drinking < 1.4 L significantly increased the risk of IBP (odds ratio [OR] 3.62, 95% confidence interval [CI] 2.65-4.95), while drinking ≥2 L was associated with adequate preparation (OR 0.09, 95%CI 0-0.42).(20)

A prospective study on 409 Chinese patients was done by Jun Fang et al and found out; chronic constipation (OR, 2.05; 95% CI, 1.31-3.23), incomplete intake of the preparation (OR 2.77; 95% CI, 1.47-5.21) and high fiber diet (OR 2.15; 95% CI, 1.40-3.28). To be independent risk factors for inadequate bowel preparation in a multivariate analysis.(21)

A case control study done in Nigeria involving 143 cases of inadequate colonic preparation and equal number of control showed that constipation, low educational level and Hypertension as predictors of poor colonic preparation on bivariate analysis of cases and controls while lower educational level was the only independent predictor identified In the multivariate analysis of risk factors, the odds ratio (OR) for secondary level of education and below was 2.54 (95% confidence interval CI 1.50-4.30; p = 0.001).(22)

An RCT done in Mexico City general hospital, Comparing 141 patients who receive phone call reminder with 117 patients who didn't receive the phone call remainder revealed a significant difference in most quality indicator parameters including improvement in BBPS. The short telephone call reminder groups where less likely to have BSS score of ≤5 with RR of 2.24 (P<0.0001).(23)

2.4 Conceptual Framework

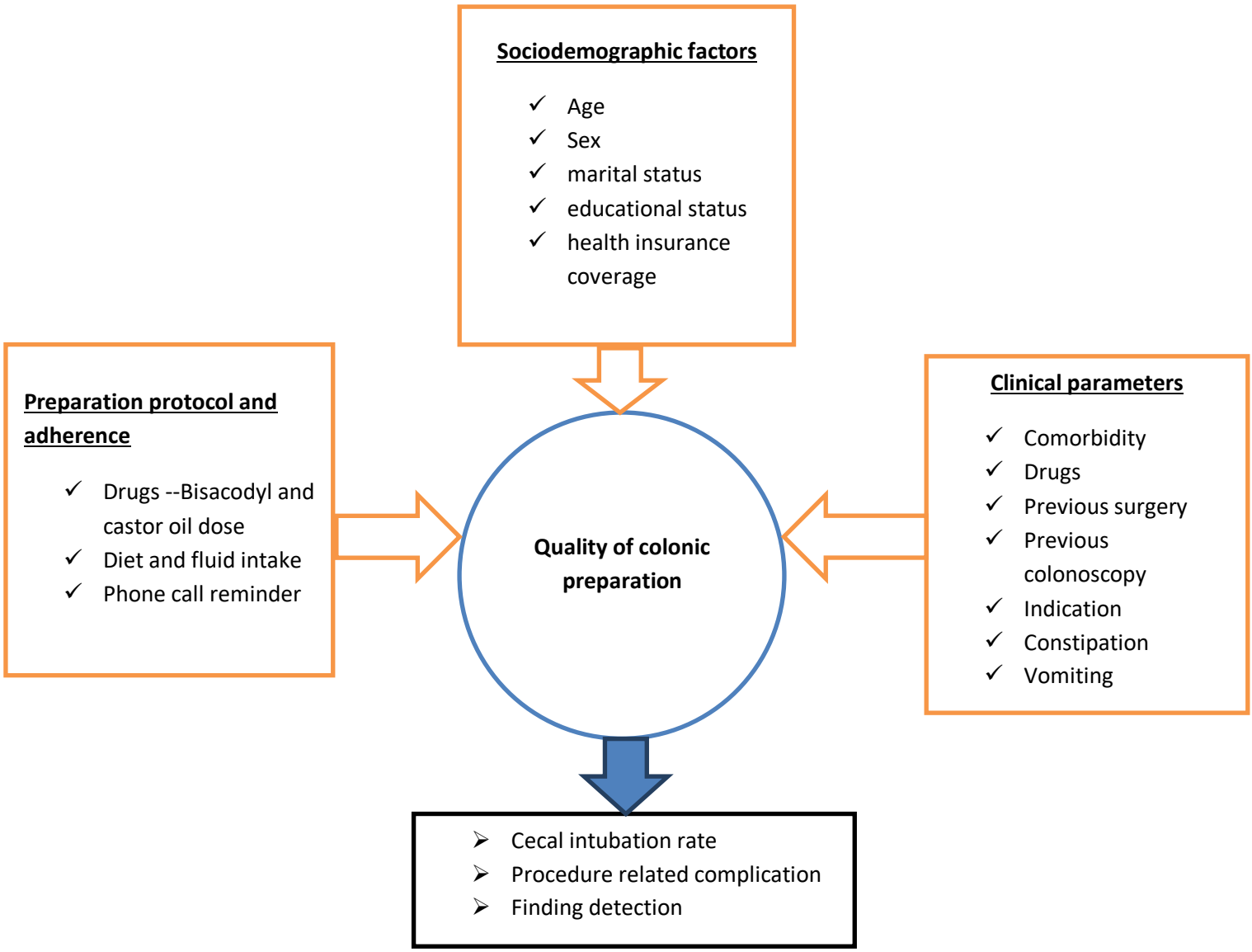

Figure 1:Conceptual framework showing relationshipbetween outcome and predictor variables

3. OBJECTIVES

3.1 Overall Objective

To determine proportion of suboptimal colonic preparation and its determinants among patients who undergo elective colonoscopy at TikurAnbessa specialized hospital.

3.2 Specific objectives

- Determine proportion of suboptimal colonic preparation
- Identify major predictors of suboptimal colonic preparation

4. METHODS AND MATERIALS

4.1Study Area and Period

4.1.1 Study area

The study was conducted at TASH, which is located in Addis Ababa, the capital city of Ethiopia. The hospital has 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 therapeuticscope services in addition to inpatient and outpatient clinical services.

4.1.2Study period

The study period wasfrom March, 2023 to August 30, 2023 G.C.

4.2 Study Design

A prospective cross sectional studywas conducted to determine the proportion and predictors of suboptimal colonic preparation among patients who undergone elective colonoscopy at TASH.

4.3Source population and Study Population

4.3.1Source Population

The source population was allpatients who undergone elective colonoscopy at TASHduring the specified study period

4.3.2Study Population

All patients who fulfill the inclusion criteria among patients who undergone elective colonoscopy at TASHon the specified study period were included in the study.

4.3.3Inclusion and exclusion criteria

Inclusion criteria

All patients who undergo elective colonoscopy on the specified study period

Exclusion criteria

Patients who have surgical stomas

Patients below 14 years of age

Patients with incomplete colonoscopy because of distal obstructive mass

Patients who receive cleansing enema

4.4 Sample size calculation

All patients who undergone elective colonoscopies during the study period were included. The calculated sample size using a single population proportion formula assuming proportion of inadequate colonic preparation as 25 % (proportion of suboptimal colonic preparation in most studies ranges from 20-31%) is 288. When 10% non-response rate is added the final sample size will be 317. 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 25% from multiple studies

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

4.5 Variables

4.5.1Independent Variable (IV)

Age

sex

Educational level

marital status

use of interpreter during colonoscopy counseling

Adherence to preparation protocol (drugs, diet and fluid intake)

Comorbidity

Medications

Previous history of colonoscopy

Indication for colonoscopy

Previous history of abdominal surgery

BMI

Vomiting during or before starting preparation

History of constipation

Urban vs. rural residency

Short telephone call before the start of preparation

4.5.2 Dependent Variables

Quality of colonic preparation (Optimal Vs. Suboptimal)

4.6 Data Collection Procedure

Socio demographic and clinical data was collected by trained health professionals using a structured, pre tested questioner, and colonoscopy related parameters including quality of colonic preparation was taken from the colonoscopy report written by the physician who performed the procedure. The data collection process was supervised by the investigators and it was checked for completeness and accuracy.

4.7 Data Analysis and Presentation

The collected data was checked for completeness, coded and transported to SPSS version 26 for analysis. Standard descriptive methods (means/percentage and standard Deviations) were used to report results. The results are presented in tables, figures and statements. Significance for association between dependent and independent variables was carried out using chi-square test where necessary. Bivariate analysis was done and all explanatory variables which have association with the outcome variable at p-value less than 0.25 were included in multivariable analysis.AOR with 95% CI, P-value of 0.05 was used to decide whether those independent variables included in multivariable analysis are statistically significant or not with outcome variable.

4.8 Ethical Considerations

The study was conducted after approval of proposal by ethical review committee of Internal Medicine Department of Addis Ababa University, College of health sciences. All patients and guardians of under 18 years old participants were informed about the nature of the study and standard informed consent taken before data collection.

4.9Data Quality Assurance

To maintain the quality of data to be collected, proper training of data collectors and regular supervision was done by the investigator. Pretest was conducted one week prior to actual data collection by the principal investigator and data was checked for consistency, accuracy and any ambiguousity. Problems identified during the pretest were corrected for final data collection. The collected data was checked for completeness and accuracy on daily base.

4.10 OPERATIONAL DEFINITIONS

Colonic preparation quality wasassessed using Aronchick scale.(3)

Table 1 Aronchick scale, colonic preparation assessment tool.

Score	Rating	Description	Adequacy
1	Excellent	Small volume of liquid; > 95% of mucosa seen	optimal
2	Good	Clear liquid covering 5%-25% of mucosa, but> 90% of mucosa seen	
3	Fair	Semisolid stool could not be suctioned or washed away, but > 90% of mucosa seen.	suboptimal
4	Poor	Semisolid stool could not be suctioned or washed away and < 90% of mucosa seen.	
5	Inadequate	Inadequate: procedure will be aborted and repeat preparation will be scheduled	

- Colonoscopy is considered incomplete if cecal intubation was not achieved
- Preparation protocol of TASH and counseling (counseling done both verbally and given in a written form)

  On the day of the procedure

  Patient will be NPO and procedure time is before mid-day

  One day prior to the procedure

  Diet ---only tea, soft drink and at least 4 liters of water

  Drugs –bisacodyl 20 mg po BID and castor oil 30ml every 4 hours

  Two days prior to the procedure

  Low fiber diets (pasta and macaroni) and fluid diet with plenty of water

- On the second half of the study period, patients receive a short telephone call to reinforce the counseling they received verbally and in written form about the preparation.

4.11 Dissemination of the result

Finally copy of the result will be disseminated to relevant authorities including Addis Ababa University College of medicine and health science. Results will be discussed with quality assurance team of the hospital. It will bepublished in reputable Journals. Also copy will be placed in the library as references.

5.Result

5.1 Sociodemographic characteristics of the participants

A total of 282 patients who fulfill the inclusion criteria were included in the study. Majority of participants (52.5%) were under 40 years of age with a mean age of 41.69 ± 15.577 (range 14–80 years). Females accounted for 58.2% (164) of the sample size and majority 258 (91.5%) were urban residents. 105 (37.2%) participant completed secondary school. More than half 163 (57.8%) were married, and 181 (64.2%) of patients have health insurance coverage (see Table 1).

Table 2Sociodemographic characteristics of patients who underwent elective colonoscopy in TASH, Addis Ababa, Ethiopia, 2023, (n=282)

Variables	Category	Frequency (n)	Percent (%)
Age	< 40 Years	148	52.5
	40-60 Years	95	33.7
	> 60 Years	39	13.8
Sex	Male	118	41.8
	Female	164	58.2
Residency	Urban	258	91.5
	Rural	24	8.5
Educational status	No formal Education	32	11.3
	Can read and write	29	10.3
	Complete Primary School	18	6.4
	Complete Secondary School	105	37.2
	College graduate	98	34.8
Marital status	Single	86	30.5
	Married	163	57.8
	Widowed	24	8.5
	Divorced	9	3.2
Use of Interpreter during counseling for preparation	Yes	105	37.2
	No	177	62.8
Have health insurance coverage	Yes	181	64.2
	No	101	35.8

5.2 Clinical parameters of the participants

A total of 154 (54.6%) of the study participants were found to have a known chronic medical condition. The most prevalent chronic illness being IBD 80 (51.9%), followed by hypertension 42 (27.3%), Diabetes mellitus 26 (16.9%), and RVI 19 (12.3%). More than half of the patients 152(53.9%) were taking at least one type of medication at the time of the study. Azathioprine (AZA) was the commonest medication 77(50.7%), followed by antihypertensive 42 (27.5%) and anti-diabetic medication 26 (17.1%). More than half of the participants 162 (57.2%) have a normal BMI, While 63 (22.3%) were underweight, 46 (16.3%) overweight, and 11 (3.9%) were found to be obese.

Previous history of abdominaopelvic surgery was reported by 86 (30.5%) of the study participants, and 132 (46.8%) had a history of previous colonoscopy. Regarding adherence to the preparation protocol; almost all of the participants 273 (96.8%) took 40mg of Bisacodyl, 221 (78.4%) took 3 bottles of Castel oil, 43 (15.2%) of patients took either 2 - 2 .5 bottles of Castel oil and the remaining 18 (6.4%) took less than two bottles of castor oil. Majority of the study participants 180 (63.8%) took solid diet 24 hours prior to the procedure and 2-4 liters of fluid was taken a day before the procedure by 67.4% of the study participants. Vomiting and history of constipation were reported by 104 (36.9%) and 91 (32.3%) of participants respectively. Phone call and counseling the day before starting the preparation, in addition to the formal counseling was done for 109 (38.7 %) of the participants on the second half of the study period.(see Table 2).

Table 3 Clinical parameters of patients who underwent elective colonoscopy in TASH, Addis Ababa, Ethiopia, 2023, (n=282)

Variables	Category	Frequency (n)	Percent (%)
Having known chronic medical condition	Yes	154	54.6
	No	128	45.4
Comorbidity (n = 154)	DM	26	16.9
	HTN	42	27.3
	Stroke	7	4.6
	IBD	80	51.9
	RVI	19	12.3
	Others*	17	11
Currently taking medications	Yes	152	53.9
	No	130	46.1
Current medications (n=152)	Anti-diabetic	26	17.1
	Anti HTN	42	27.6
	AZA	77	50.7
	TCA	5	3.3
	ART	19	12.5
	Others**	18	11.8
Body Mass Index	<18.5 (Underweight)	63	22.3
	18.5-24.9 (Normal)	162	57.4
	25-29.9 (Overweight)	46	16.3

	> 30 (Obese)	11	3.9
History of abdominal surgery	Yes	86	30.5
	No	196	69.5
Previous history of colonoscopy	Yes	132	46.8
	No	150	53.2
Adherence to Bisacodyl preparation	< 40mg	9	3.2
	40mg	273	96.8
Adherence to Castel oil preparation	< 2 bottles	18	6.4
	< 3bottles	43	15.2
	3 bottles	221	78.4
Last taken of solid diet	<24 hours	102	36.2
	> 24 hours	180	63.8
Amount of fluid taken before procedure	< 2 Litters	11	3.9
	2-4 Liters	190	67.4
	> 4 liters	81	28.7
History of vomiting	Yes	104	36.9
	No	178	63.1
History of constipation	Yes	91	32.3
	No	191	67.7
Phone counseled on preparation	Yes	109	38.7
	No	173	61.3

***Others*:** *Bladder ca, Blood ca, Breast ca, cancer disease, CML, Epilepsy, HBV, heart disease, ovarian ca, PTB, RCC, sarcoma, TB* ***Others**:** *Anti-TB, Aspirin, chemotherapy, epilepsy drug, Imatinib, Metroly, MTX and UDCA*

5.3 Colonoscopy related parameters

The leading indication for colonoscopy was mucosal healing assessment 93 (33.0%) followed by constipation 30 (10.6%), rectal bleeding 25 (8.9%), abdominal pain 24 (8.5%), diarrhea 23 (8.2%) and imaging evidence of mass or intestinal wall thickening 20 (7.1%). Quality of preparation was optimal in 155(55%) patients of which 93 (33%) were graded excellent. Suboptimal preparation accounts for the remaining 127(45%) percent while 43(15.2%) procedures were cancelled because of inadequate preparation.

Successful cecal intubation was possible in 192(95.5%) of 201 eligible patients. No immediate complication was reported in 235(98.3%) of patients while 3(1.2%) patients had significant abdominal distention and 1(0.4) reported severe abdominal pain. Majority of the procedures 207(86.6%) were done by Fellows and the commonest 25 (10.4%) reported challenge during the procedure was redundant sigmoid colon with frequent looping. IBD was the commonest disease category identified accounting for 31.8% (76 of 239) of the cases followed by normal colonosopic finding 70(29.2%), hemorrhoids 23(9.6%), polyp 17(7.1%) and mass lesion 14(8.6%).(See Table 3).

Table 4: Colonoscopy related parameters of patients who underwent elective colonoscopy in TASH, Addis Ababa, Ethiopia, 2023, (n=282)

Variables	Category	Frequency (n)	Percent (%)
Indication of Colonoscopy	Mucosal healing assessment	93	33.0
	Constipation	30	10.6
	Metastatic workup	11	3.9
	Imaging evidence of mass/thickening	20	7.1
	Diarrhea	23	8.2
	Rectal bleeding	25	8.9
	Anemia	15	5.3
	Abdominal pain	24	8.5
	Surveillance	16	5.7
	Others	25	8.9

Quality of preparation	Excellent	93	33.0
	Good	62	22.0
	Fair	48	17.0
	Poor	36	12.8
	Inadequate	43	15.2
Successful cecal intubation (n=239)	Yes	192	80.3
	No	9	3.8
	Non applicable	38	15.9
Immediate complication (n=239)	None	235	98.3
	Distention	3	1.2
	Sever pain	1	0.4
Challenge during colonoscopy (n=239)	Redundant colon/sigmoid with looping	25	10.4
	Deformed colon	6	2.5
	Surgically modified anatomy	9	3.7
	Colonic stenosis	5	2.0
	None	194	81.1
Colonoscopy done by (n=239)	Fellow	207	86.6
	Consultant	2	0.8
	Both	30	12.5
General category of the disease (n=239)	Normal	70	29.2
	Colitis	8	3.3
	Polyps	17	7.1
	Mass lesions	14	5.8
	Hemorrhoid	23	9.6
	IBD	76	31.8
	Terminal ileitis	9	3.8
	Others	22	9.2

5.4 Factors associated with suboptimal colonic preparation

In bivariate analysis, variables such as age, use of interpreter while counseling for colonosopic preparation, having health insurance, having established chronic medical conditions (HTN, stroke), current taking of medications (Anti-DM, TCA), Amount of castor oil taken, total amount of fluid intake in liters, history of constipation, phone counseling a day prior to the start of preparation, indication for colonoscopy, and successful cecal intubation were associated with quality of colonic preparation.

In multiple logistic regression analysis, variables such as age, current use of anti-DM medications, Dose of castor oil taken , and phone counseling were found to be significantly associated with colonic preparation at a 95% confidence interval.

Patients in the age group more than 60 years were 7.23 times more likely to have suboptimal colonic preparation (AOR: 7.23, 95%CI: 1.05, 49.44), p = 0.044). Those patients who were taking anti-DM medications were 6.65 times less likely to have suboptimal colonic preparation compared to those who were taking other types of medications (AOR: 6.25, 95%CI: 1.10, 35.34), p = 0.038). Patients who had taken less than 2 bottles of castor oil (120ml) were 9 times more likely to have sub-optimal colonic preparation compared to those who had taken 2-2.5 bottles of castor oil for colonic preparation (AOR: 0.09, 95%CI: 0.01, 0.83), p = 0.034). Patients who did not have phone counseling were 3.55 times more likely to have suboptimal colonic preparation compared to those who had telephone counseling (AOR: 3.55, 95%CI: 1.08, 11.62), p = 0.036) (Table 4).

Table 5: Factors associated with suboptimal colonic preparation of patients who underwent elective colonoscopy in TASH, Addis Ababa, Ethiopia, 2023, (n=282)

Variables	Category	Colonic Preparation		COR (95%CI)	AOR (95%CI)	p-value
		Optimal	Suboptimal			
Age in years	< 40	89	59	1	1	
	40-60	51	44	1.30 (0.77, 2.19)	1.78 (0.52, 5.98)	0.352
	> 60	15	24	2.41 (1.17, 4.97)	**7.23 (1.05, 49.44)**	**0.044**
Interpret during counseling for preparation	Yes	64	41	1	1	
	No	91	86	1.47 (0.90, 2.40)	1.06 (0.31, 3.53)	0.924
Having health insurance	Yes	110	71	1	1	
	No	45	56	1.92 (1.17, 3.15)	1.98 (0.67, 5.79)	0.211
HTN disease	Yes	16	26	1	1	
	No	63	49	0.47 (0.23, 0.98)	0.59 (0.17, 2.06)	0.414
Stroke disease	Yes	1	6	1	1	
	No	78	69	0.14 (0.01, 1.25)	0.06 (0.00, 1.11)	0.060
Anti-DM	Yes	16	10	1	1	
	No	61	65	1.70 (0.71, 4.04)	**6.25 (1.10, 35.34)**	**0.038**
TCA	Yes	1	4	1	1	
	No	76	71	0.23 (0.02, 2.14)	1.74 (0.04, 75.12)	0.773
Adherence to castor oil preparation	< 2 bottles	5	13	1	1	
	2-2.5 bottles	23	20	0.33 (0.10, 1.10)	**0.09 (0.01, 0.83)**	**0.034**
	3 bottles	127	94	0.28 (0.09, 0.82)	0.52 (0.08, 3.13)	0.480
Total amount of fluid intake in liters	< 2 L	3	8	1	1	
	2-4 L	102	88	0.32 (0.08, 1.25)	0.32 (0.00, 33.87)	0.635
	> 4 L	50	31	0.23 (0.05, 0.94)	0.21(0.00, 25.03)	0.525
History of constipation	Yes	44	47	1	1	
	No	111	80	0.67 (0.40, 1.11)	0.87 (0.24, 3.09)	0.840
Phone counseled	Yes	85	24	1	1	
	No	70	103	5.21 (3.02, 8.99)	**3.55 (1.08, 11.62)**	**0.036**
Indication of colonoscopy	Mucosal healing assessment	53	40	1	1	
	Constipation	17	13	1.01 (0.44, 2.32)	0.56 (.07, 4.15)	0.572

	Metastatic workup	2	9	5.96 (1.22, 29.12)	0.54 (0.01, 23.35)	0.752
	Imaging evidence of mass/thickening	5	15	3.97 (1.33, 11.84)	4.24 (0.21, 83.05)	0.340
	Diarrhea	17	6	0.46 (0.16, 1.29)	0.55 (0.06, 5.01)	0.601
	Rectal bleeding	12	13	1.43(0.59, 3.48)	0.72 (0.10, 5.10)	0.747
	Anemia	6	9	1.98 (0.65, 6.04)	1.99 (0.31, 12.64)	0.464
	Abdominal pain	15	9	0.79 (0.31, 2.00)	1.02 (0.06, 15.22)	0.988
	Surveillance	9	7	1.03 (0.35, 3.00)	0.26 (0.02, 2.80)	0.267
	Others	19	6	0.41 (0.15, 1.14)	0.90 (0.10, 8.20)	0.930
Successful cecal intubation	Yes	131	61	1	1	
	No	4	5	2.68 (0.69, 10.34)	1.20 (0.07, 19.60)	0.894
	Non-applicable	20	18	1.93 (0.95, 3.91)	1.92 (0.64, 5.72)	0.240

p-value< 0.05 was considered as statistically significant; COR: Crude odds ratio; AOR: Adjusted odds ratio; CI: Confidence interval; TCA: Tricyclic antidepressants; DM: Diabetes mellitus, HTN: Hypertension

6. Discussion

Safety and diagnostic Yield of colonoscopy done for any indication is closely related to the adequacy of pre procedure bowel cleansing. Although The rate of suboptimal bowel cleansing is recommended not to exceed 15%, Multiple studies have shown nearly 20-30% of bowel preparations to be suboptimalin our study the rate of suboptimal colonic preparation was 45% which is inconsistent with other study findings and very far from guidelines recommendations for optimal mucosal evaluation.(2,12,15,16)

The proportion of cancelled procedures because of inadequate preparation was also high (15.2%), Compared to a study performed by Douglas K et al in 200 outpatient colonoscopies Which shows procedure abortion rate to be 6.5% at the public hospital 1% at private hospitals because of inadequate preparation. This difference in the rate of suboptimal preparation and procedure abortion maybe explained by the difference in the type of cleansing regimens used, almost all studies done in other setups use PEG and sodium phosphate liquidwhile in our set up we use combination of castor oil and Bisacodyl.(4)

This study revealed old age as independent predictor of suboptimal colonic preparation , patients aged 60 years and more where 7.23 times more likely to have suboptimal colonic preparation. This is consistent with different studies. A study by Benjamin Lebwohland his colleagues on 12,430 patients found out old age to independent predictor of suboptimal preparation. A similar finding was demonstrated by Amir Sadeghi et al on 2,476 elective colonoscopies. This can be explained by impaired bowel motility with aging resulting decreased evacuation of colonic contents. (16,17).

In our study taking less than 2 bottles (120) ml of castor oil was associated with suboptimal colonic preparation which is consistent with a study done by Jun Fang et al on 409 chines patients, where incomplete intake of preparation medication was found to be independent predictor of suboptimal colonic preparation (21)

Another significant predictor of suboptimal colonic preparation demonstrated in this study was taking anti diabetic medications, which was associated with 6.25 times less risk of suboptimal preparation compared to others. The reason for low rate of suboptimal preparation is not known and it is not demonstrated in other studies which looked for association of medications with quality of colonic preparations. (15,17,19).

In our study short telephone call a day before starting preparation to reinforce counseling was another strong predictor of quality of bowel preparation. On descriptive statistics, the proportion of patients having suboptimal preparation was far less in the telephone group 22% (24 of 109) than the standard counseling group 59% (103 of 173). Patients who did not have phone counseling were 3.55 times more likely to have suboptimal colonic preparation compared to those who had phone counseling (AOR: 3.55, 95%CI: 1.08, 11.62), p = 0.036).This finding was consistent with AnRCT done in Mexico City general hospital, Comparing 141 patients who receive phone call reminder vs 117 patients who didn't receive the phone call remainder. This study revealed a significant difference in most quality indicator parameters including improvement in BBPS.(23)

7. Conclusion

Our study revealed unacceptably high proportion of suboptimal bowel preparation and procedure cancellation rate. Clinical variables independently associated with quality of preparation include; old age, adherence to preparation regimen, anti-diabetic medication intake and telephone counseling. Therefore intervention targeting these predictors should be designed to improve quality of pre –colonosopic bowel preparation.

8. Recommendation

Taking this data in to account, quality improvement office of the hospital should design a mechanism to improve quality of bowel preparation to the recommended level.

We recommend The GI unit of TASH to incorporate short telephone call as a means of reinforcing counseling on adherence to preparation protocol a day before starting the preparation.

Special emphasis should be given to elderly people during counseling.

We recommend local researches to do multicenter studies including comparative studies with different protocols to generate data that help to validate or change the current preparation protocol.

9. Limitations of the study

Major limitation of the study is the fact that it was a single center study in a teaching hospital so the findings of this study may not be generalizable other settings.

The other limitation is we take self-reported weight to calculate BMI which may introduce a recall bias.

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Annex

Annex-I Information sheet

Title of the project: **proportion and determinants of suboptimal bowel preparation among patients who undergone elective colonoscopy at TASH; a prospective observational study**

Name of investigators: Dr. Abel Girma

Background of the study

We would like to see Magnitude of suboptimal colonic preparation and its determinants on patients who underwent colonoscopy at TASH during the study period.

Confidentiality

During the data collection name and personal identifications will not be asked. All information collected during the study about patients will be coded and the data collection tools will be locked and will not be accessed by any individuals. All the data and the information will be kept confidential.

Who is organizing and funding the research?

Research grant will be from AAU post graduate office CHS. The research organized by researchers in Addis Ababa University, SOM, internal medicine department, Gastroenterology and hepatology unit . The Research protocol has been reviewed by research committee of internal medicine Department and by institutional review board of AAU, CHS.

Institutional Review Board (IRB) address:

Collage of health sciences

Addis Ababa University

Addis Ababa, Ethiopia

Contact person Dr. Abel Girma Tel.0918706003

E-mail address: abelgirma13@yahoo.com

Annex II Informed consent form

I am Dr. Abel Girma, Gastroenterology and Hepatology fellow at Addis Ababa University, college of health sciences. I am doing research on Adequacy of colonic preparation and its predictors among patients who undergo elective colonoscopy at BLH. I am going to give you information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research. This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask me.

The purpose of the research is to identify predictors of poor colonic preparation and design a better way of doing it so that it will be as safe and effective as possible.

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. We are inviting you to take part in this research project. If you accept, you will be asked few questions related to your disease and your clinical, laboratory, imaging and endoscopic data's will be used for the research.

You not be judged about your preparation and There will not be any diagnostic investigation or additional cost to be incurred on you for the study purpose.

There will be no direct benefit to you, but your participation in this research is likely improve the quality of bowl preparation in future colonoscopies.

I will not be sharing information about you to anyone outside of the research team. The information that we collect from this research project will be kept private. Any information about you will have a number on it instead of your name. Only the researchers will know what your number is and we will lock that information up with a lock and key

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Signature of the participant ----------

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

Name and Signature of the researcher----------

Date ----------

Annex III- Questionnaire **Card/Icare**……

I_ Socio demographic data

1. **Age in years…….**

2. **Sex**
   A. Male B. Female

3. **Area of residency**
   A. Urban B. Rural

4. **Educational status**
   A. No formal education C. Completed secondary education
   B. Can read and write D. College graduate

5. **Marital status**
   A. Single B. Married C. Widowed D. Divorced

6. **Was there interpreter during counseling for preparation**
   A. Yes
   B. NO

7. **Do you have health insurance?**
   A. Yes
   B. NO

II- Clinical parameters

8. Comorbidity

A. DM B. HTN C. Stroke D. Others E. None

9. Current medications

A. NSAID B. TCA C. Iron D. Antihypertensive

E. Others F. None

10. Height (cm)_____ weight(kg) _____ BMI _____

11. Current Site of care

A. Inpatient B. out patient

12. History of abdominal surgery

A. Yes B. NO

13. Previous history of colonoscopy

A. Yes B. NO

14. Adherence to the preparation protocol (Drug, diet , Fluid)

Drugs ……1 Bisacodyl taken in mg …….

2 Caster oil in bottle ……...

When was last intake of solid diet ……

Total amount of fluid taken a day before the procedure in liters……

15. History of vomiting before or after starting preparation

Yes No

16. History of constipation

Yes No

17. Did you get short telephone call as a reminder of date of procedure and preparation

Yes NO

III- Colonosopic finding

18. Indication for colonoscopy

……

19. Successful Cecal Intubation

A. Yes B. No

20. Quality of preparation using Aronchick scale

A. Excellent B. Good C. Fair D. Poor E. Inadequate

21. Any immediate complication

A. None B. Bleeding C. Perforation D. abdominal pain
E. distention F. Other

22. Challenge during colonoscopy:

A. Redundant colon/ sigmoid with looping
B. Deformed colon
C. Surgically modified anatomy
D. Colonic stenosis
E. None

23. Colonoscopy is done by:

A. Fellow **B. Consultant** **C. Both**

24. General category of the disease

A. Normal
B. Stricture or stenosis
C. Extrinsic compression
D. Colitis
E. Polyps
F. Mass lesions
G. Vascular disease
H. hemorrhoid
I. ulcer
J. Diverticula
K. IBD
L. Terminal ileum
M. Other disease of the LGI system

Annex IV **Amharic version of Consent and Questionnaire**

<u>የጥናቱመረጃናየተሳታፊዎችየፍቃደኝነትቅጽ</u>

እኔዶ/ርአቤልግርማእባላለሁ፤በአዲስአበባዩኒቨርስቲበጥቁርአንበሳሆስፒታልየአንጀት፣
የጨጓራናየጉበትሰብእስፔሻሊቲየመጨረሻዓመትተማሪነኝ።

የመመረቂያጽሁፌንየምሠራውትልቁንአንጀትለመመርመርየምናደርገውንየኮሎኖስኮፒምርመራየተሳካለማ
ድረግየሚደረገውንየሁለትቀንዝግጅትውጤታማነትናተግዳሮትየሚወስኑነገሮችንመለየትላይነው።

እርስዎፈቃደኛከሆኑለዚህጥናትግብዓትለሚሆኑጥያቄዎችበሙሉፈቃደኝነትመልስእንዲሰጡኝእየጠየኩመረ
ጃውበሚስጢርየሚያዝናለሌላአገልግሎትየማይውልመሆኑንእንዲሁምለጥያቄዎችየሚሰጡትምላሽየሚያገ
ኙትየህክምናአገልግሎትላይምንምአይነትተጽእኖእንደማይፈጥርአረጋግጥልዎታለሁ።.

ከላይየተሰጠውንማብራሪያየተረዱከሆነእናበጥናቱለመሳተፍያለምንምተጽእኖፈቃደኛከሆኑከታችበተሰጠ
ውቦታፊርማዎትንበማስቀመጥፈቃደኛነትዎንያረጋግጡልኝ።

የተሳታፊፊርማ …….

የመረጃሰብሳቢስምናፊርማ……..

ቀን፡- ……

አይኬርቁጥር ……. **ኮድ……**

ሀ. <u>የተሳታፊውአጠቃላይመረጃ</u>

1. እድሜ ……ዓመት
2. ፆታሀ. ወንድለ. ሴት
3. የመኖሪያቦታ

ሀ. ከተማለ. ገጠር

4. የትምህርትደረጃ

ሀ. መደበኛትምህርትአልተማርኩም

ለ. ማንበብናመፃፍእችላለሁ

ሐ. 1ኛደረጃንአጠናቅቄያለሁ

መ. 2ኛደረጃንአጠናቅቂያለሁ

ሠ. ከፍተኛትምህርትተምሪያለሁ

5. የትዳርሁኔታ

ሀ. ያላገባለ. ያገባሐ. የፈታመ. ባለቤቱ/ቷበሞትየተለየ

6. ስለዝግጅቱበባለሙያመመሪያሲሰጥዎትአስተርጓሚአስፈልጓል ?

ሀ. አዎአስፈልጓልለ. አላስፈለገም

7. የጤናመድህንተጠቃሚነዎት ?

ሀ. አዎለ. አልጠቀምም

8. የህክምናአገልግሎቱንእያገኙያሉበትቦታ

ሀ. በተመላላሽለ. በተኝቶህክምና

ለ. **<u>ጤናነክመረጃዎች</u>**

9. ተጓዳኝህመምአለዎት ? ካለዎትየትኛውንእንደሆነይምረጡ

ሀ. ስኪርለ. ግፊትሐ. ስትሮክመ. ሌሎችሠ. የለም

10. በአሁኑሰዓትየሚወስዱትመድኃኒት

ሀ. የህመምማስታገሻለ. የስኪርመድኃኒት

ሐ. የግፊትመድኃኒትመ. አይረንሠ. አሚትሪፕትሊን

ረ. ሌሎችሰ. የለም

11. ቁመት …….ሴ.ሜክብደት ……..ኪ.ግ

የክብደትለቁመትምጣኔ (BMI) ……..

12. ከዚህበፊትየሆድእቃቀዶህክምናተደርጎለዎትያውቃል ?

ሀ. አዎለ. አልተደረገልኝም

13. ከዚህበፊትየኮሎኖስኮፒምርመራተደርጎለዎትያውቃል ?

ሀ. አዎለ. አድርጌአላውቅም

14. የዝግጅቱንመመሪያመተግበርበተመለከተ

- ስንትሚ.ግቢሳኮዳይልወሰዱ ……..
- ስንትቢልቃጥካስተርኦይልወሰዱ ……
- ለመጨረሻጊዜደረቅምግብየወሰዱትመቼነው …….
- ባለፈው 24 ሰዓትውስጥስንትሊትርፈሳሽወሰዱ ……

15. ዝግጅቱንከማድረግዎበፊትወይምከጀመሩበኋላማስመለስነበረዎት ?

ሀ. አዎአስመልሶኛል

ለ. አላስመለሰኝም

16. የሰገራድርቀትአለዎት ?

ሀ. አዎአለኝ

ለ. የለኝም

ሐ. <u>የኮሎኖስኮፒምርመራውጤትመረጃ</u>

17. ምርመራውያስፈለገበትምክንያት ……

18. የመጨረሻውየትልቁአንጀትክፍል (cecum) ታይቷል ?

    ሀ. አዎ

    ለ. አልታየም

19. በአሮንችክመመዘኛመሠረትየዝግጅቱደረጃምንያክልነው?

    ሀ. በጣምጥሩ (Excellent) ለ.ጥሩ (Good)

    ሐ. በቂ (Fair) መ.ዝቅተኛ (Poor)

    ሠ. በጣምዝቅተኛ (Inadequate) (ምርመራውንመሥራትየማያስችል)

20. ከምርመራውጋርተያይዞየተፈጠረየጎንዮሽጉዳት

    ሀ. የለምለ. መድማት

    ሐ. የአንጀትመበሳትመ. ከፍተኛየሆድህመም

    ሠ. የሆድመነፋትረ. ሌላካለይጥቀሱ

21. የኮሮኖስኮፒምርመራውንአስቸጋሪያደረገክስተት

    ሀ. ከመጠንበላይየተጣጠፈትልቁአንጀት

    ለ. የአንጀትጥበት

    ሐ. ከተለመደውወጣያለየአንጀትቅርጽ

    መ. በቀዶጥገናየተቀያየረየአንጀትቅርጽ

    ሠ. ምንምአይነትችግርአልነበረም

22. ምርመራውየተሠራውበማንነው ?

    ሀ. በሰልጣኝ (Fellow)

    ለ. በኮንሰልታንት

    ሐ. በሁለቱም

23. የተገኘውየበሽታውአይነት ……..