PREVALENCE OF IRRITABLE BOWEL SYNDROME, CELIAC DISEASE AND THEIR MANIFESTATIONS AMONG MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES STAFF AND STUDENTS

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DEPARTMENT OF INTERNAL MEDICINE



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By

Adam Miraj Gembe, MD

A Dissertation submitted in Partial Fulfillment of Requirement for the Degree of Master of Medicine in Internal Medicine of

Muhimbili University of Health and Allied Sciences
October, 2019

CERTIFICATION

The undersigned certifies that, he has read and hereby recommend for examination by Muhimbili University of Health and Allied Sciences a dissertation entitled: ***"Prevalence of irritable bowel syndrome, celiac disease and their manifestations among Muhimbili University of Health and Allied sciences staff and students"*** in partial fulfillment of requirement for the degree of Master of medicine in Internal Medicine Muhimbili University of Health and Allied Sciences.

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E. Komba MD., MMED., MSc. Gastroenterology

(Supervisor)

_____

Date

DECLARATION AND COPYRIGHT

I, **Adam Miraj Gembe** declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature: …… Date: …….....

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ABSTRACT

Background: Global prevalence of irritable bowel syndrome is high among medical students and health care professionals with significant morbidity. Similarly, the prevalence of celiac disease in irritable bowel syndrome is higher than the general population. These conditions impair quality of life and contribute to social-economic burden. In Tanzania, little is known about irritable bowel syndrome and celiac disease among medical students and health care professionals.

Objective: To determine the prevalence of irritable bowel syndrome, celiac disease in irritable bowel syndrome and their manifestations among MUHAS staff and students.

Methodology: A cross sectional study was conducted to MUHAS and Mloganzila Academic Medical Center (MAMC) staff and students who fulfilled the online shared Rome IV criteria of irritable bowel syndrome from August to November 2018. A structured questionnaire was used to collect socio-demographic data, anthropometric measurements and clinical manifestations. Blood samples for full blood picture, liver enzymes and Erythrocyte Sedimentation Rate were taken. Celiac disease was tested using anti-tissue transglutaminase antibody test. Qualitative and quantitative data were summarized using frequency distribution tables. Chi-square and fishers exact test were used to study comparison between groups. Logistic regression was used to study associations. Data was analyzed using SPSS version 20.0 and a P value of ≤ 0.05 was considered significant.

Results: Out of 1,321 participants, 192 (14.5%) had irritable bowel syndrome in which 77 (40.1%) were males and 115 (59.9%) were females. Among the 192 participants with irritable bowel syndrome, 3 (1.6%) were positive for celiac disease, 2 (66.7%) were females and 1 (33.3%) was a male. Of the 3 patients with CD, 2 had elevated ALAT and 1 had anaemia. Age (AOR 2.53, 95% C.I 1.57-4.09), sex (AOR 1.67, 95% C.I 1.16-2.41), marital status (AOR 4.95 C.I 2.07-11.82), alcohol intake (AOR 2.47, 95% C.I 1.16-5.23), year of study (AOR 8.49, 95% C.I 5.71-12.64) and sleep duration (AOR 2.24, 95% C.I 1.23-4.06) were found to be independently associated with IBS.

Conclusion: Prevalence of IBS and its associated factors in our study population was similar to findings from studies done elsewhere. Also, our study revealed a low prevalence of celiac disease among IBS participants.

TABLE OF CONTENTS

CERTIFICATION ii
DECLARATION AND COPYRIGHT iii
ACKNOWLEDGEMENTS iv
ABSTRACT v
LIST OF FIGURES x
LIST OF TABLES x
LIST OF ABBREVIATIONS xi
DEFINITION OF TERMS xii
CHAPTER ONE 1
1.0 INTRODUCTION 1
1.1 Background 1
1.2 Literature Review 4
1.2.1 Prevalence of irritable bowel syndrome 4
1.2.2 Socio-demographic characteristics and manifestations of irritable bowel syndrome 4
1.2.3 Factors associated with irritable bowel syndrome 5
1.2.4 Prevalence of celiac disease in irritable bowel syndrome 5
1.2.5 Socio-demographic characteristics and manifestations of celiac disease in irritable bowel syndrome 6
1.3 Conceptual Framework 8
CHAPTER TWO 9
2.0 PROBLEM STATEMENT AND OBJECTIVES 9
2.1 Problem statement 9
2.2 Rationale of the Study 9
2.3 Research Questions 10
2.4 Objectives 10
2.4.1 Broad objective 10
2.4.2 Specific objectives 10
CHAPTER THREE 11
3. 0 METHODOLOGY 11

3.1 Study design 11
3.2 Study site 11
3.3 Study population 11
3.4 Inclusion criteria 11
3.5 Exclusion criteria 11
3.6 Study duration 12
3.7 Sampling technique 12
3.8 Recruitment method 12
3.9 Variables 13
3.10 Data collection tool and investigations 13
3.11 Description of test procedure 14
3.12 Test result interpretation 15
3.13 Data analysis 16
3.14 Ethical consideration 16
CHAPTER FOUR 18
4.0 RESULT 18
4.1 The prevalence of IBS among MUHAS staff and students 21
4.2 The socio-demographic characteristics and manifestations of IBS among MUHAS staff and students. 21
4.3 The factors associated with IBS among MUHAS staff and students 23
4.4 The prevalence of celiac disease among MUHAS staff and students with IBS 24
4.5 The socio-demographic characteristics and manifestations of celiac disease among MUHAS staff and students with IBS 24
CHAPTER FIVE 26
5.0 DISCUSSION 26
5.1 Study Strength 29
5.2 Study Limitations 29
CHAPTER SIX 30
6.0 CONCLUSION AND RECOMMENDATIONS 30
6.1 Conclusion 30
6.2 Recommendations 30
7.0 REFERENCES 31

8.0 APPENDICES 38
8.1 Annex I: Informed Consent Form – English Version 38
8.2 Annex II: Informed Consent Form – Swahili Version 41
8.3 Annex III: Rome IV Diagnostic Criteria for IBS 43

LIST OF FIGURES

Figure 1: The relationship between IBS, CD, socio demographic and their clinical manifestations. 8

Figure 2: Blood sample application on the CD rapid test.....14

Figure 3: Negative CD test 15

Figure 4: Positive CD test.....15

Figure 5: Flow chart showing enrolment of study participants. 17

LIST OF TABLES

Table 1: The demographic, anthropometric, clinical and laboratory characteristics of study participants among MUHAS staff and students.....19

Table 2: The socio-demographics characteristics and manifestations of IBS among MUHAS staff and students 22

Table 3: Factors associated with IBS among MUHAS staff and students before and after adjustment 23

Table 4: The socio-demographic characteristics and manifestations of celiac disease among MUHAS staff and students with IBS 25

LIST OF ABBREVIATIONS

ALAT	-	Alanine aminotransferase
AOR	-	Adjusted odds ratio
ASAT	-	Aspartate aminotransferase
BMI	-	Body mass index
CD	-	Celiac disease
EMA	-	Endomysial antibody
ESR	-	Erythrocyte sedimentation rate
GFD	-	Gluten free diet
HB	-	Haemoglobin
HLA	-	Human leukocyte antigen
IBS	-	Irritable bowel syndrome
IDA	-	Iron deficiency anemia
IFNγ	-	Interferon gamma
IgA	-	Immunoglobulin A
IgG	-	Immunoglobulin G
IgM	-	Immunoglobulin M
Kg/m^2	-	$Kilogram/meter^2$
MAMC	-	Muhimbili Academic Medical Centre
MCV	-	Mean Cell Volume
MCHC	-	Mean Cell Hemoglobin Concentration
MUHAS	-	Muhimbili University of Health and Allied Sciences
OR	-	Odds ratio
PLT	-	Platelets
QoL	-	Quality of life
T1DM	-	Type 1 diabetes mellitus
tTGA	-	tissue transglutaminase
WBC	-	White blood cells

DEFINITION OF TERMS

For the purpose of this study, the following definitions were used:
ANAEMIA is haemoglobin in men <13 g/dl and in women <11.5 g/dl.

CELIAC DISEASE is a chronic, multi-organ autoimmune disease that affects the small intestine in genetically predisposed individuals.

CONSTIPATION is any two of the following features: straining, lumpy hard stools, sensation of incomplete evacuation, use of digital maneuvers, sensation of anorectal obstruction or blockage with 25 percent of bowel movements, and decrease in stool frequency (less than three bowel movements per week).

DIARRHEA is the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual).

IRRITABLE BOWEL SYNDROME is a recurrent abdominal pain on average at least 1 day per week during the previous 3 months that is associated with two or more of the following: related to defecation (may be increased or unchanged by defection), associated with a change in stool frequency or associated with a change in stool form or appearance.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

What is celiac disease and irritable bowel syndrome

Celiac Disease (CD) is an enduring gluten sensitive autoimmune disease affecting the small intestine in genetically predisposed persons (1). It was discovered in 1888 by Samuel Gee in a report entitled "on the celiac affection" (2).

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder characterized by abdominal pain and altered bowel habits in the absence of a specific bowel pathology. It is among the most common diagnosis that makes up to 30% of all referrals to gastroenterologists (3). IBS is classified based on the dominant stool pattern, that is, IBS with diarrhea (IBS-D), IBS with constipation (IBS-C) and IBS with both diarrhea and constipation (IBS-M) (4).

CD shares several symptoms that are present in the Rome IV criteria used in the diagnosis of IBS (5). Typically CD presents with chronic diarrhea, weight loss and failure to thrive. Atypically CD presents with iron deficiency, bloating, constipation, chronic fatigue, unexplained elevations in serum aminotransferases, headache, abdominal pain, and osteoporosis (2,6–8). As a result, IBS-like symptoms may delay CD diagnosis as CD is considered less prevalent in many regions compared to IBS.

Both CD and IBS affect all age groups from children to the elderly. However, more than 50% of IBS patients have onset of symptoms before the age of 35 years (9,10). A case finding study in Jordan found that CD was present in patients aged between 18-61 years with mean age of 33.5 years (11). On the contrary, a cross sectional study in India showed that, the mean age of CD diagnosis was slightly lower at 29.2 years whereas in the USA, the mean age of CD diagnosis was found to be slightly higher 40.72 years (12,13).

Globally, IBS and CD occur more commonly in females than males. Similarly, co-existence of CD and IBS is more evident in females compared to males (3,12).

Pathogenesis

Gluten, present in wheat, barley and rye is composed of gliadins and glutenins. Gliadin is deaminated by an enzyme, tissue transglutaminase (tTGA), producing a negatively charged peptide that is immunogenic to the adaptive immune system. Consequently, activation of macrophages, dendritic cells, and B cells, which express the Human Leukocyte Antigen (HLA) class II DQ2 and/or DQ8 molecules on their surfaces that interact with gliadin-specific CD41 T-Helper 1(TH1) cells producing inflammatory cytokines, such as interferon gamma (IFN-γ). Cumulative inflammatory damage results into histological CD findings of villous atrophy and crypt hyperplasia (14–16). On the other hand, the pathogenesis of IBS is not exactly known. It is postulated that an interaction between genetic factors, gut motility, visceral hypersensitivity, psychological factors and immune mediated factors results into IBS (17).

Diagnosis

CD may be diagnosed by serology for specific antibodies and duodenal biopsy (14). Anti-tTG Immunoglobulin A (IgA) is a first line test with sensitivity of 90.9% and negative predictive value of 99.6%. It is less expensive compared to anti-Endomysial antibody test (EMAIgA) with sensitivity of 85.7% and negative predictive value of 99.7% (14).

IBS is diagnosed based on the Rome IV criteria that is composed of the following; recurrent abdominal pain (≥1 day per week, on average, in the previous 3 month), with an onset ≥6 month before diagnosis. The abdominal pain should be associated with at least two of the following three symptoms: pain related to defecation, change in frequency of stool or change in stool form (18).

Treatment

The cornerstone of CD treatment is a gluten free diet (GFD) (19). Despite longer periods of histological improvements, 95% of CD persons show clinical improvement on GFD within days to weeks (20). Approximately 5% of patients are refractory to GFD hence; intensive therapy with corticosteroids and immune-modulators is added (20).

IBS treatment is directed towards the predominant symptom such as constipation, diarrhea and abdominal pain. Cognitive-behavior therapy, gut-directed hypnosis, psychodynamic therapy and relaxation training are other IBS therapies being studied (17).

Complications

CD complications entails; mal-absorption leading to iron deficiency anaemia, lactose intolerance, enteropathy associated T cell lymphoma, cerebellar ataxia, peripheral neuropathy, IgA nephropathy, type 1 diabetes, autoimmune thyroiditis, infertility, miscarriage, low birth weight and osteoporosis (19,20).

1.2 Literature Review

1.2.1 Prevalence of irritable bowel syndrome

IBS carries a high transcontinental prevalence of up to 20% (21). Health care professionals and medical students have been found to have high IBS prevalence rates which is thought to be a result of nervousness, mental stress and depression (22–24).

Studies from Asia have shown variable prevalence rates of IBS among medical students and health care professionals. In Malaysian medical students, the prevalence of IBS was found to be 15.8% whereas among Saudi Arabian medical student the prevalence of IBS was 31.8% (25,26). In the same way, another study among health care professionals in Pakistan revealed a prevalence of 28.4% (27). In Japanese medical and nursing students, the prevalence of IBS was 35.5% (28).

Studies from African medical students and health care professionals have shown comparable prevalence rates of IBS to some studies in Asia. In studies among Nigerian medical students, the prevalence of IBS was found to be 14.4% and 26.1% (29,30). On the other hand, a study among nurses in Nigeria found that, the prevalence of IBS was 45.2% (31).

1.2.2 Socio-demographic characteristics and manifestations of irritable bowel syndrome

IBS has been found to be most prevalent in the second and third decades of life with females known to be more affected than males.

A study in Saudi Arabia among medical students, revealed that, females were more affected than males with a mean age at diagnosis of 21.84±1.64 years (32). Similar findings were observed in Chinese medical students where females were predominant with mean age at diagnosis of 20.53±1.59 years(33). Further, a study among health care professionals in Turkey and Pakistan showed that non-smoking females were greatly affected with mean ages at diagnosis of 32±7.59 years and 33.0±7.0 years respectively (27,34).

In Africa, studies among medical students in Nigeria and Sudan showed similar findings with studies in Asia. However, a relative high mean age at diagnosis of 26.3±4.1 years was evident in Nigeria (29,35).

IBS is characterized by chronic abdominal pain and altered bowel habits. Altered bowel habits includes: diarrhea, constipation, alternating diarrhea and constipation.

The pattern of IBS symptoms is variable across the globe. Studies from Japan, Saudi Arabia and Pakistan medical and nursing students have shown a predominance of IBS-M subtype 13.8%, 71.3% and 55% respectively (24,28,36). On the contrary, IBS-C subtype was predominant among Iranian medical students (81.6%) whereas IBS-D was predominant among health care professionals in Pakistan (56.81%) (34,37).

In African medical students and health care professionals, a comparable pattern of symptoms has been shown to resemble some studies in Asia. IBS-M subtype (58.7%) and (60.7%) was common among Nigerian students and nursing staff respectively (29,31).

1.2.3 Factors associated with irritable bowel syndrome

IBS has been associated with various factors; young age, being female, anxiety, depression, poor sleep quality and positive family history. Studies among medical students in Asia found that anxiety, depression, family history and being a female in second decade of life was significantly associated with IBS (28,38,39).

Furthermore, among health care professionals in Turkey and Pakistan; being a female, long working hours, family history of IBS and alcohol intake were associated with IBS (34,40).

Nevertheless, in Africa, significant factors associated with IBS among Nigerian medical students were female gender and anxiety (29). On the other hand, multiple qualifications, involvement in shift duties, age below 30 years and practice less than 5 years were independently associated with IBS among nurses in Nigeria (31). Although factors associated with IBS are by and large similar across populations, differences do exist.

1.2.4 Prevalence of celiac disease in irritable bowel syndrome

Globally the overall prevalence of CD in the general population is relatively low with studies in Europe, Asia and Africa demonstrating prevalence rates of 2.4%, 1.6% and 0.28% correspondingly (41–43).

Although a low prevalence of CD is seen in the general population, a higher prevalence of CD is evident among IBS patients.

In North America (Mexico), the prevalence of CD in patients with IBS was found to be 5.25% and 1.5% in healthy individuals (44). Similarly, a meta-analysis including European, Asian and African countries found that the pooled prevalence of CD among IBS patients based on the tTG antibodies was 4.48% (45).

Studies from Asia showed a relative higher prevalence of CD in IBS compared to aforementioned studies in Europe and America. Studies from Japan, India and Iran revealed the prevalence of CD in IBS to be 12.8%, 6.1% and 5.5% respectively (13,46,47).

In Africa, the prevalence of IBS in different population groups has been recorded as high as 20% (21). Even with many publications on IBS prevalence, little is known on the co-existence of IBS and CD. In Egypt a study among IBS patients found that the prevalence of CD was 8% (3).

1.2.5 Socio-demographic characteristics and manifestations of celiac disease in irritable bowel syndrome

Unlike IBS, CD has been shown to affects both males and females equally. Furthermore, CD may present as late as 5th decade. Studies done in Iran and India found that CD equally affects males and females (47,48). On the contrary, in Jordan, it was found that CD affects more females than males (11).

In recent decades, CD has been having more of the atypical clinical presentations such as; iron deficiency anemia, constipation, elevated liver transaminases and bloating compared to the typical clinical presentations of; diarrhea and weight loss (49).

In Jordan, it was found that diarrhea was the most common presentation coupled with other mal-absorptive features; iron deficiency anemia, hypocalcaemia and hypo-albuminemia (11). Likewise, in India diarrhea and iron deficiency were the most common clinical manifestations of CD (48). On the contrary, studies in Iran found constipation and bloating to be the most prominent presentations (50,51).

In a meta-analysis involving North American, Asian, European and African countries revealed similar findings with Asian studies displaying diarrhea to be the most common clinical presentation of CD in IBS (45).

Moreover, CD may present with subclinical elevation in liver transaminases (52).

Studies in Egypt, further assessed the derangement in liver enzymes, erythrocyte sedimentation rate (ESR), and electrolytes where almost all laboratory parameters were normal with exception of low hemoglobin in one study that was consistent with other studies elsewhere (3,53).

Therefore, based on these findings, anemia is the most common atypical CD presentation (54). For that reason, patients with anemia and in particular iron deficiency anemia should be evaluated for presence of CD.

1.3 Conceptual Framework

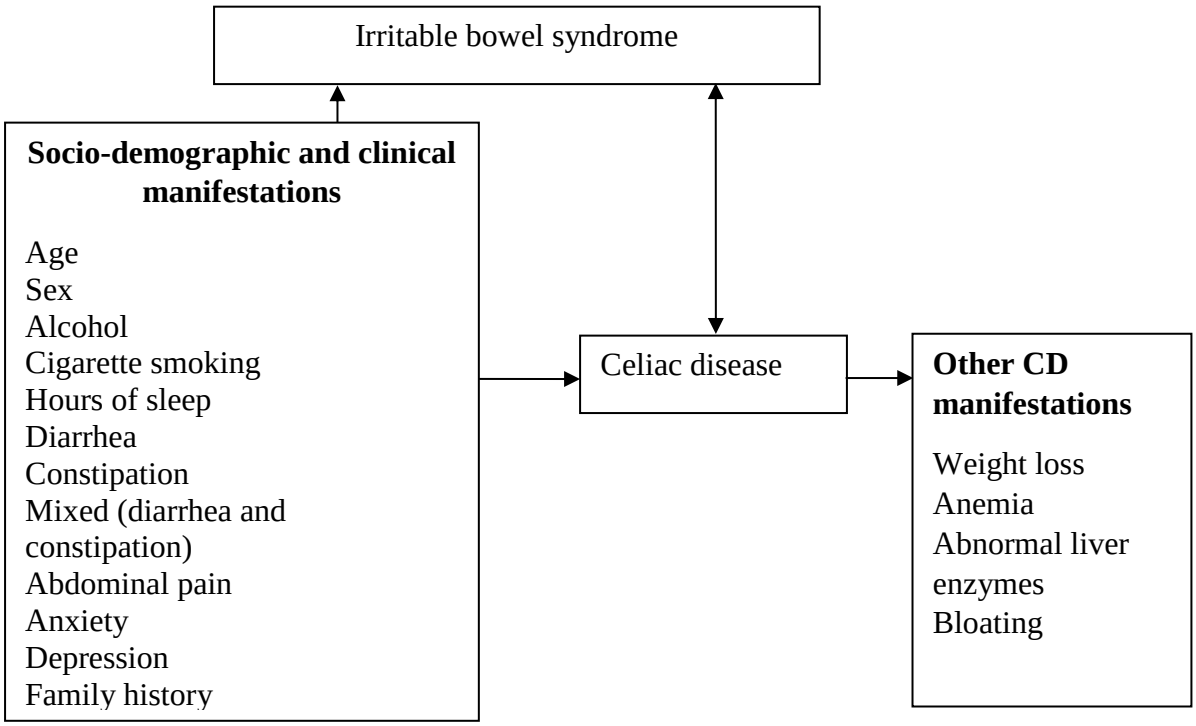


Figure 1: The relationship between IBS, CD, socio demographic and their clinical manifestations.

IBS and CD share similar socio-demographic characteristics namely; age, sex, alcohol and cigarette smoking.

Also, depression, anxiety, family history, long working/studying hours among health care professionals and medical students respectively, has been associated with IBS.

Both IBS and CD share similar clinical manifestations; diarrhea, constipation and abdominal pain. CD may further present with iron deficiency anemia, bloating, weight loss and elevated transaminases aspartate aminotransferase (ASAT) and alanine aminotransferase (ALAT).

CHAPTER TWO

2.0 PROBLEM STATEMENT AND OBJECTIVES

2.1 Problem statement

The global burden of people affected with IBS is of public importance. Evidence has shown that, there is a high prevalence of this condition among medical students and health care professionals (39,40,56). In addition, reports indicate that the prevalence of CD among patients with IBS is higher compared to the general population (3,35,36).

IBS affects directly the quality of life (QoL) as it results into; insomnia, low self-esteem, reduced dietary intake, nutritional deficiencies, social-detachment, work, and school absenteeism. Additionally, this condition may increase the economic burden in terms of cost of treatment and prevention at the individual and national level (57).

Co-existence of CD and IBS predispose an individual to long term complications associated with significant morbidity.

Despite a high prevalence of IBS among medical students and health care professionals worldwide, availability of cost-effective and sensitive rapid screening tools for CD, the prevalence of IBS and CD among MUHAS staff and students remain unknown.

2.2 Rationale of the Study

Although IBS and CD are widespread bowel disorders across the globe, little is known about its prevalence and manifestations in Tanzania. Furthermore, the disease burden remains unknown among medical students and health care professionals in Tanzania, a population that has been documented to have high IBS prevalence elsewhere in the world.

Considering scarcity of data on both IBS and CD in our settings, the results obtained from this study will provide information on prevalence, manifestations of IBS and CD among MUHAS staff and students using a cost-effective and less invasive serological test.

In addition, this study will provide information on the disease burden of IBS and CD among staff and students at MUHAS. Such information may increase awareness about IBS and CD which in turn will lead to early detection and management of patients with these two conditions.

2.3 Research Questions

What is the burden of IBS and CD among staff and students at MUHAS?

2.4 Objectives

2.4.1 Broad objective

- To determine the prevalence of irritable bowel syndrome, celiac disease in irritable bowel syndrome and their manifestations among MUHAS staff and students.

2.4.2 Specific objectives

- To determine the prevalence of IBS among MUHAS staff and students.
- To describe the socio-demographic characteristics and manifestations of IBS among MUHAS staff and students.
- To describe the factors associated with IBS among MUHAS staff and students.
- To determine the prevalence of celiac disease among MUHAS staff and students with IBS.
- To describe the socio-demographic characteristics and manifestations of celiac disease among MUHAS staff and students with IBS.

CHAPTER THREE

3. 0 METHODOLOGY

3.1 Study design

This was a cross-sectional study.

3.2 Study site

The study was conducted at MUHAS and Mloganzila Academic Medical Center (MAMC) at Mloganzila campus with a total population of 2,500.

MUHAS has five schools; namely Medicine, Dentistry, Pharmacy, Nursing, and Public Health and Social Sciences, two institutes; Institute of Allied Health Sciences and Institute of Traditional Medicine and twelve directorates.

MAMC is composed of 11 departments; Department of Internal medicine, general surgery, obstetrics and gynecology, pediatrics, orthopedic surgery, emergency, radiology, pharmacy, ophthalmology, psychiatry, and ear/nose/throat.

This setting was chosen as it has a population with wide genetic heterogeneity, a likely population that consumes gluten-containing grains and a population that has shown to have a high prevalence of IBS from literature review.

3.3 Study population

Students and health care professional staff members (nurses and doctors) at MUHAS and MAMC respectively.

3.4 Inclusion criteria

- Age of 18 years and above.
- All who consented to participate in the study.

3.5 Exclusion criteria

- Females who had dysmenorrhea and Rome IV symptoms.
- None consenting persons

3.6 Study duration

The study was conducted from August to November 2018.

Sample size and calculation:

$n = \frac{z^2 p(1-p)}{\varepsilon^2}$

Where: n = minimum sample size

z = standard normal deviate (1.96)

p = 12.9% Mirghani et al, the spectra of selected functional gastrointestinal disorders in Sudanese university students according to the Rome III criteria (35).

Ɛ = boundary of error (0.05).

None response= 10%

Therefore,

$n=\frac{1.96^2 \text{ X } 12.9\ (100\text{-}12.9)}{5^2}$

n=173

Taking a none response of 10%

$n'=\frac{n \text{ X } 100\%}{100\%\text{-}10\%}$

$n'=\frac{173 \text{ X } 100\%}{100\%\text{-}10\%}$

The minimal sample size obtained is **192** people.

3.7 Sampling technique

A consecutive sampling technique was employed in which all MUHAS health care professional staff and students on their respective areas were recruited until the sample size was attained.

3.8 Recruitment method

Health care professional staffs were introduced to the study through morning departmental meetings on their respective stations while students were introduced to the study after lecture hours. Participants were then required to complete an online survey Google document that was shared in various social network groups of staff and students (annex III). Agreeing to complete the survey, implied consent to participate in the study. The

survey tool questions were based on ROME IV criteria for irritable bowel syndrome where study participants were required to fill their mobile phone number, respond to the 8 questions in the tool and complete the socio-demographics section.

Then, those who fulfilled the ROME IV criteria of IBS were contacted via mobile phone and completed a second part of the questionnaire as described in the data collection tool that composed of anthropometric measurements and laboratory characteristics (annex IV).

Thereafter, participants were classified into diarrhea predominant IBS (IBS-D) if they had loose, mushy or watery stools in the last 3 month (question 8) without hard or lumpy stools (question 7); constipation predominant (IBS-C), if they had lumpy or hard stools without loose, mushy or watery stools in the last 3 month; Mixed IBS (IBS-M) if they had both hard stools and loose, mushy or watery stool in the last 3 month; and un subtype IBS (IBS-U), if they had neither hard, lumpy nor loose, mush or watery stool in the last 3 month.

3.9 Variables

In this study, the dependent variables were CD serology (positive/negative) and presence/absence of IBS where-as independent variables were socio-demographic characteristics, manifestations of CD/IBS, anthropometric measurements and laboratory findings.

3.10 Data collection tool and investigations

A structured questionnaire (annex IV), was completed by a research assistant/principal investigator on the anthropometric measurements and laboratory characteristics.

Anthropometric measurements were taken using a standard weighing scale that measured weight in kilograms. The device was calibrated daily before measurement.

Participants were required to remove shoes and stand straight against the weight scale where the head piece was brought down to the maximum head point where height in centimeters was recorded. Weight in kilograms and height in meters were used to calculate the body mass index (BMI).

A Celiac Quick test (BIOHIT CELIAC QUICK TEST LOT NO X46.83), an immune-chromatographic test designed for the qualitative detection of antibodies (IgA/IgG/IgM) against human tissue transglutaminase in whole blood sample, was used for screening of CD.

It has an added advantage of reducing risk of IgA deficient false negatives with sensitivity and specificity of 99% and 98.9% respectively (55). Test results were obtained within ten minutes of sample collection.

Also the research assistant (medical student) /principal investigator (medical doctor) collected blood for full blood picture (FBP), Liver transaminases and erythrocyte sedimentation rate (ESR) from the study participants. Results of these tests were entered in the participant's laboratory characteristics.

3.11 Description of test procedure

Whole blood was collected by a puncture at the median cubital vein after cleansing with an alcohol swab and air drying, 10mls of blood was collected, 5mls for FBP, ESR, CD rapid test and 5mls for liver enzymes.

The left forearm was positioned facing upwards, then using a sterile 10cc syringe; the median cubital vein was punctured. 5mls of blood were kept in red capped bottles and 5mls were kept in purple capped bottles. The used needle was then discarded immediately into a biohazard box.

Using a micropipette, a small amount of blood was extracted from the purple topped bottles for CD rapid test immediately after sample collection. Gently the blood sample was dispensed onto the test cassette as shown in figure 2 below.

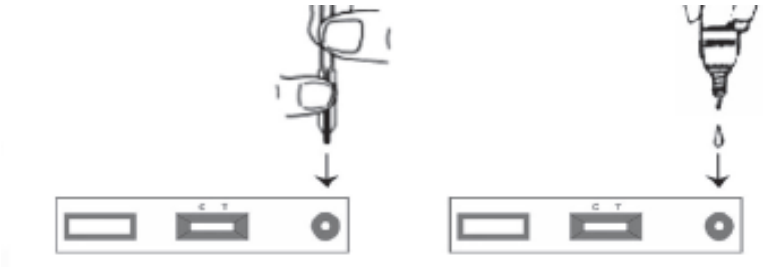


Figure 2: Blood sample application on the CD rapid test.

30–60 seconds were allowed to elapse until the blood has been absorbed, then two drops of dilution buffer were added in the same window. One drop at a time was added, holding the dropper bottle in a vertical position. Results were read in ten minutes after diluents addition.

Liver transaminases were analyzed using BIOTECNICA chemistry analyzer model BT3500 whereas FBP was analyzed using NIHON KOHDEN hematology analyzer.

3.12 Test result interpretation



Figure 3: Negative CD test

NEGATIVE: Only one BLUE band appears across the result window close to the "C" letter (Control line) of the test cassette. This band must always appear.



Figure 4: Positive CD test

POSITIVE: In addition to the BLUE control band, a distinguishable PINK-RED band also appears across the result window close to the letter "T" (Test line) of the test cassette. The intensity of the line depends on the concentration of antibodies in the sample.

If no BLUE band appeared in the control area, the test was INVALID and was repeated with a new test cassette. Any line or color that appeared after 10 minutes had no diagnostic value.

3.13 Data analysis

The data obtained from the questionnaires was entered into statistical package of social sciences (SPSS) version 20 for Windows for data analysis. Cross checking of filled questionnaires after data collection was done for quality control of data.

The qualitative variables such as: sex, cigarette smoking/alcohol, manifestations CD and IBS were summarized using frequency distribution tables.

Quantitative variables in the study included; ages, number of seropositive and seronegative, were summarized by frequency distribution. Mean and standard deviation were employed for age.

Comparison of categorical variables between groups was performed using chi-square tests or fishers exact test. Logistic regression was employed to study for associations. The level of significance used was P= 0.05.

The prevalence of IBS was calculated from those who fit the ROME IV criteria (192) divided by those who responded to the online ROME IV criteria (1321). On the other hand the prevalence of CD was calculated from those who tested positive for CD (3) divided by the total number of participants with IBS tested for CD (192).

3.14 Ethical consideration

Permission was sought from MUHAS administration and MUHAS research ethical committee. Among participants who fulfilled the ROME IV criteria and contacted for completion of the laboratory tests and anthropometric measurements, a written informed consent (annex I) was obtained from all participants that a vein puncture will be done to obtain a blood sample that was to be used for this study only.

Participants with CD were advised on the avoidance of gluten containing foods while those with IBS were counselled on symptomatic management options.

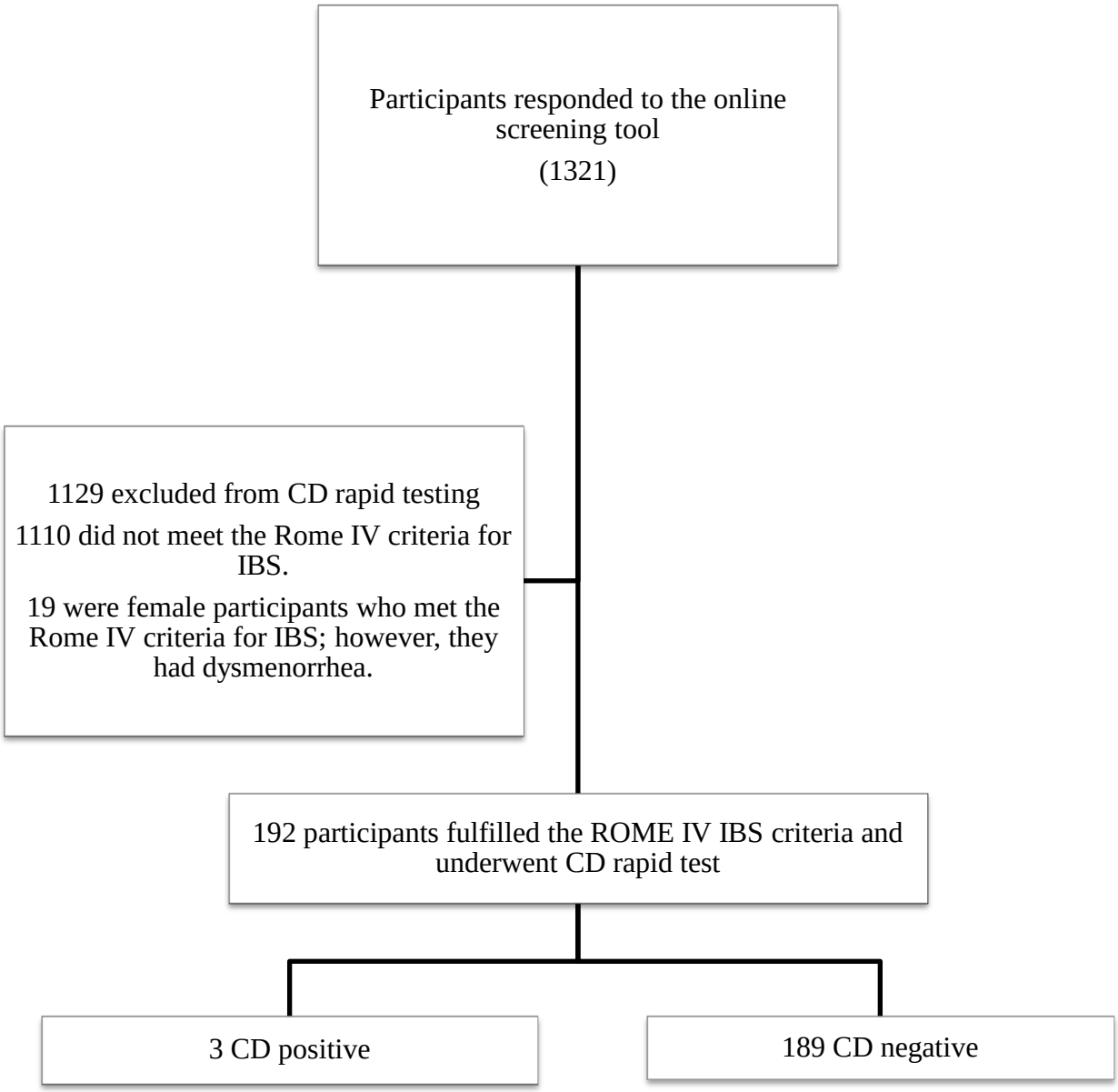


Figure 5: Flow chart showing enrolment of study participants.

CHAPTER FOUR

4.0 RESULT

A total of 1,321 MUHAS staff and students were screened of which 192 participants fulfilled the ROME IV criteria for IBS and were screened for CD as shown in figure 5 above. The mean age of study participants was 25±4.04 years where 698 (52.8%) were females. Majority of study participants were single 1054 (79.8%) and students 1161 (87.9%). Ongoing students 982 (74.3%) accounted for greater part of student participants, where the highest number of participants 812 (61.5%) were from school of medicine. School of dentistry had least participants 28 (2.1%). Sleep duration was less than 7 hours in most of the study participants 1046 (79.2%) as described in Table 1 below.

Cigarette smoking and alcohol were uncommon among the study participants thus, 7 (0.5%) and 111 (8.4%) in that order.

An alteration of abdominal pain, constipation and diarrhea was the predominant clinical manifestation evident in 445 (33.7%) participants while diarrhea alone was the presenting complaint in 130 (9.8%) participants.

The mean HB, red blood cell indices, liver enzymes and ESR among IBS study participants were within normal limits. The mean BMI among IBS participants was 23±2.6 kg/m^2.

Table 1: The demographic, anthropometric, clinical and laboratory characteristics of study participants among MUHAS staff and students. N=1321

Characteristics		**N (%)**
Age	Mean age years±SD	25±4.04
Age groups	18-27	992 (75)
	28-37	317 (24)
	38-47	10 (0.8)
	48-57	2 (0.2)
Sex	Female	698 (52.8)
	Male	623 (47.2)
Marital status	Single/divorced/widow/er	1054 (79.8)
	Married/cohabiting	267 (20.2)
Alcohol	Ever	111 (8.4)
Smoking	Ever	7 (0.5)
Occupation	Student	1161 (87.9)
	Employee	160 (12.1)
School/Institute of students (N=1161)	Medicine	812 (61.5)
	Dentistry	28 (2.1)
	Pharmacy	84 (6.4)
	Nursing	95 (7.2)
	Allied sciences	107 (8.1)
	Public health	35 (2.6)
Year of study (N=1161)	Ongoing	965 (83.1)
	Finalist	196 (16.9)
Hours of sleep	≤7hours	1046 (79.2)
	>7hours	275 (20.8)
Clinical manifestations		
Symptoms	Abdominal pain	356 (26.9)
	Constipation	292 (22.1)
	Diarrhea	130 (9.8)
	Mixed	445 (33.7)
	None	98 (7.5)

Laboratory characteristics N=192		
HB	Grams/deciliter mean±SD	13.2±1.1
MCV	Femtoliters	91.2±5.5
MCHC	Grams/deciliter	31.5±1.3
ESR	Millimeter/hour	4.71±1.6
ALAT	Units/liter	22.9±5.4
ASAT	Units/liter	23.9±4.6
Anthropometric measurements N=192		
Height (range)	Centimeters mean±SD	162.11±6.6
Weight	Kilograms	61.32±7.3
BMI	Kilograms/meter^2 (kg/m^2)	23.3±2.6

Continuous variables were presented as mean ± standard deviation, while categorical variables are presented as proportions, N: number of participants, body mass index was calculated using height and weight (BMI= weight in kg /height in meters^2. HB; hemoglobin, MCV; mean cell volume, MCHC; mean cell hemoglobin concentration, ESR; erythrocyte sedimentation rate, ALAT Aspartate aminotransferase, ALAT; Alanine aminotransferase and BMI; body mass index.

4.1 The prevalence of IBS among MUHAS staff and students

The prevalence of IBS among MUHAS staff and students was 14.5%.

4.2 The socio-demographic characteristics and manifestations of IBS among MUHAS staff and students.

The baseline characteristics in participants with IBS and those with no IBS were similar in terms of smoking, current status (student/employee) and abdominal pain as part of the symptomatology however; those below an age 25 years, females, alcohol users, with single marital status and sleep duration less than seven hours were significantly predominant in the IBS arm. Moreover, among students, IBS was more evident in final year students compared to the ongoing students. Furthermore, diarrhea, abdominal pain alternating with diarrhea and constipation were significant seen among IBS participants whilst constipation predominating in the no IBS arm as shown in Table 2 below.

Table 2: The socio-demographics characteristics and manifestations of IBS among MUHAS staff and students N=1321

Characteristics		**No IBS N=1129 (%)**	**IBS N=192 (%)**	**P-value**
Age	≤25	673 (59.6)	135 (70.3)	0.005
Sex	Female	583 (51.6)	115 (59.9)	0.03
Alcohol	Ever used	88 (7.8)	23 (12)	0.05
Smoking	Ever smoked	4 (0.4)	3 (1.6)	0.07
Hours of sleep	≤7 hours	877 (77.7)	169 (88)	0.001
Marital status	Single	881 (78)	173 (90.1)	<0.001
Current status	Student	986 (87.3)	175 (91.1)	0.134
Study year (N= 1161)	Finalist	106 (10.8)	90 (51.4)	<0.001
Clinical manifestations				
Symptoms	Abdominal pain	164 (14.5)	192 (100)	0.646
	Diarrhea	86 (7.6)	44 (22.9)	<0.001
	Constipation	252 (22.3)	40 (20.8)	<0.001
	Mixed	337 (29.8)	108 (56.2)	<0.001
	None	290 (25.7)		

4.3 The factors associated with IBS among MUHAS staff and students

A total of seven variables namely age, sex, alcohol, smoking, marital status, year of study and sleep duration were entered in the univariate logistic regression analysis model. Age less than 25 years, female sex, being single, sleep duration less than 7 hours and finalist students were found to increase the probability of IBS.

All variables were entered in multivariate logistic regression analysis. After adjusting for cigarette smoking, age below 25 years (AOR 2.53, 95% C.I 1.57-4.09), female sex (AOR 1.67, 95% C.I 1.16-2.41), single marital status (AOR 4.95 C.I 2.07-11.82), alcohol use (AOR 2.47, 95% C.I 1.16-5.23), final year of study (AOR 8.49, 95% C.I 5.71-12.64) and sleep duration of less than 7 hours (AOR 2.24, 95% C.I 1.23-4.06) were found to be independently associated with IBS as shown in Table 3 below.

Table 3: Factors associated with IBS among MUHAS staff and students before and after adjustment N=1321.

Variable		P-value	Crude OR	95% C.I	P-value	Adjusted OR	95% C.I
Age	≤25 years	0.005	1.61	1.15-2.24	<0.001	**2.53**	1.57-4.09
Sex	Female	0.04	1.40	1.03-1.91	<0.01	**1.67**	1.16-2.41
Alcohol	Ever used	0.06	1.61	0.99-2.62	0.02	**2.47**	1.16-5.23
Smoking	Ever smoked	0.05	4.46	0.99-20.11	0.27	3.29	0.39-27.43
Marital status	Single	<0.001	2.56	1.56-4.20	<0.001	**4.95**	2.07-11.82
Year of study	Finalist	<0.001	5.16	3.67-7.24	<0.001	**8.49**	5.71-12.64
Sleep duration	<7 hours	0.001	2.11	1.34-3.34	0.01	**2.24**	1.23-4.06

4.4 The prevalence of celiac disease among MUHAS staff and students with IBS

The prevalence of CD among MUHAS staff and students with IBS was 1.6%.

4.5 The socio-demographic characteristics and manifestations of celiac disease among MUHAS staff and students with IBS

There were 3 celiac disease patients among MUHAS staff and students with IBS; 2/3 (66.7%) were females. All CD patients were below age of 25 years, never smoked cigarette or taken alcohol.

All patients with celiac disease had normal BMI. Bloating was common among CD patients. The predominant IBS subtype among the CD positive patients was diarrhea 2 (66.7%).

One CD patient had mild microcytic hypochromic anemia whilst elevated ALAT was evident in 2 patients as shown in Table 4 below.

Table 4: The socio-demographic characteristics and manifestations of celiac disease among MUHAS staff and students with IBS N=3.

Sociodemographic characteristics		Positive celiac rapid test N (%)
Age	≤ 25years	3 (100)
Sex	Male	1 (33.3)
	Female	2 (66.7)
Alcohol	Never	3 (100)
Smoking	Never	3 (100)
Clinical characteristics		
IBS subtype	Mixed (%)	1 (33.3)
	Diarrhea (%)	2 (66.7)
Bloating	Sometime (%)	2 (66.7)
	Most of the time (%)	1 (33.3)
Anthropometric measurements		
BMI	18-24.9 (%)	3 (100)
Laboratory characteristics		
Hemoglobin	Normal	2 (66.7)
	Low	1 (33.3)
RBC indices	Microcytic hypochromic	1 (33.3)
	Normocytic normochromic	2 (66.7)
ASAT	<40 units/L	3 (100)
ALAT	<40 units/L	1 (33.3)
	≥40 units/L	2 (66.7)
ESR	<15 millimeter/hour	3 (100)

Normal hemoglobin in females was defined as HB ≥ 11.5g/dl where normal HB in males was defined as HB≥13g/dl. Normal RBC indices MCV (80-100) MCHC (30-35). Normal ALAT and ASAT (0-40units/L). Normal ESR males <15mm/hour and <20mm/hour females.

CHAPTER FIVE

5.0 DISCUSSION

The prevalence of IBS among medical students and health care professionals in this study was found to be 14.5%. The finding is similar with reported findings among medical students in Saudi Arabia (13.7%), Iran (12.6%), Nigeria (14.4%) and health care professionals in Turkey (13.5%) (29,34,56,57). On the other hand, a higher prevalence of IBS was reported among medical students in China (33.3%), Pakistan (28.3%), Nigeria (26.1%) and Nigerian nursing staff (45.2%) (24,30,39,58).

Screening tools and/or criteria greatly influence the prevalence rates of IBS. Studies that used ROME II/III criteria showed higher prevalences rates among Nigerian students (26.1%) and Nigerian nursing staff (45.2%) respectively (30,31). Similarly, studies in Saudi Arabia and Pakistan using ROME III criteria showed prevalence rates of 31.8% and 28.3% respectively (26,59). On the other hand, studies that used ROME IV criteria, the current IBS diagnostic criteria, had low prevalences rates among medical students in Saudi Arabia (15.64%) and (17.5%) (38,60). Similarly, this study was conducted using ROME IV criteria.

The patho-physiology behind high prevalence rates of IBS among medical students is thought to be due to constant nerve-wracking environment to meet deadlines, examinations anxiety, long working and studying hours and less hours of sleep (61). On the other hand, the high prevalent rates of IBS among health care professionals is thought to be because of the stressful environment due to the nature of the work and working environment (34).

Although not fully defined, in a genetically predisposed individuals, stressful environment alter the micro biome-gut-brain axis that is key in IBS symptomatology (4). Stress, enhances the increase in systemic pro inflammatory cytokines and activates the hypothalamus pituitary adrenal axis. In turn, increased levels of corticotrophin releasing factor (CRF) from the hypothalamus that alters gut permeability causing infiltration of inflammatory cells, localized inflammation and mucosal edema. This results in changes in visceral neuromuscular function hence, IBS symptoms (4,62).

IBS manifests in four major clinical subtypes as describe in literature review. Our study found that IBS-M subtype was common among MUHAS staff and students (56.3%).

Similar findings have been reported among studies in Asian and other African population; Pakistan (55%), China (43.9%) and Nigeria (60.7%) (24,39,58).

IBS has been shown to be associated with several factors as described here within; evidence displays that female gender is more prone to IBS as revealed in our study (59.9%) and supported by studies from Iran (15%), Japan (41.5%) and Turkey (19.7%) (28,34,56). Several mechanisms have been put forward to describe the dominance of IBS among females. Factors such as high levels of pro inflammatory factors (Interleukin-17 and TNF-α) and low levels of anti-inflammatory factors (Interleukin-10) have been observed in females compared to males with IBS. Furthermore, females with IBS have presented with high levels of colonic mucosal mast cells and less of CD3+ and CD8+ T cells signifying that mucosal immune activation is sex dependent in IBS (63,64).

Age below 25 years is seen to be associated with increased risk of IBS in our study as well as studies from Saudi Arabia (60%,) and Pakistan (57.6%) and (24,38).

Further, alcohol use has been linked with IBS. Our study found that alcohol consumption was common among participants with IBS (12%). Similarly, several other studies have shown increased risk of IBS among alcohol users; Lebanon (24%), China (30.5%) and Saudi Arabia (27.3%) (60,65,66).

Alcohol consumption has been shown to alter gastro intestinal motility, absorption and permeability. In turn, this increases the effect of Fermentable Oligosaccharides, Disaccharides, Monosaccharides and Polyols (FODMAPs) that result into IBS symptoms (67,68).

Among students, finalist are more at risk of IBS compared to ongoing students as shown in our study and similarly in many other studies in Saudi Arabia (45%, 29% and 34.6%) (23,40,69). This is postulated to be as a result of increased hours of studying and less hours of sleep.

There are fewer studies that addressed marital status as an IBS risk factor. Our study found that single marital status is associated with IBS conversely, a study among Iranian medical students found that married students had more IBS than single students however, this difference was not statistically different (37).

A disturbance in the circadian rhythm has been linked to the development of IBS symptoms. Our study found that IBS was predominant in participants with sleep duration less than 7 hours (88%). Similar findings have been reported among medical and nursing students in China, residents in London and medical students in Saudi Arabia (34.3%) (26,28,70).

Evidence shows existence of CD among patients with IBS with variable burden across the globe. In our study, the prevalence of CD in participants with IBS was 1.6%. Similarly, studies from Asia (India 2%) and Europe (Turkey 2%) relieved comparable CD prevalence among IBS patients (48,71). On the contrary, studies from Asia (Iran 10.5%), North America (Mexico 5.21%) and some African countries (Egypt 8%) have revealed high prevalences of CD among IBS patients (47,48,71). The low prevalence observed in study may be due to the fact that CD is uncommon in the sub-Saharan Africa.

The manifestation of CD in IBS varies among different subtypes of IBS. In our study, CD was found in two patients with IBS-D subtype and one patient with IBS-M subtype. Similarly, CD among IBS-D subtype is common in Asian and African population, followed by IBS-M subtype and occasionally in IBS-C subtype (11,47,72).

Furthermore, CD may present with bloating and weight loss, however, recent evidence has shown a decline in weight loss as a typical CD presentation (73). Our study found that all CD patients had bloating and normal body mass index (BMI). Normal mean BMI has been reported in studies from India and Mexico (44,48). However, some studies in Saudi Arabia and Jordan have shown underweight and overweight among CD patients with IBS respectively (11,74).

CD may present typically or atypically. Current trend shows a rise in atypical manifestation of CD such as asymptomatic elevation of ALAT, ASAT and ESR. Increased ALAT and ASAT has been link to nonalcoholic steatohepatitis (NASH) that occurs as a result of increased intestinal permeability that escalates translocation of gut bacteria, kupffer cell stimulation, production of tumor necrosis factor-α (TNF-α), pro-inflammatory cytokine, and reactive oxygen species.

In addition to, CD share common immunogenic factors and immunopathogenesis with other hepatobiliary disorders such as autoimmune hepatitis, primary biliary cirrhosis and

primary sclerosing Cholangitis that may contribute to asymptomatic elevation in liver enzymes (75). In this study, two CD patients had elevated ALAT with normal ASAT and ESR.

IDA was uncommon in this study (1 out of 3) and similar trends were evident in studies in India and Jordan (11,48). IDA in CD occurs as a result of loss of iron in the bowel enterocytes and mal-absorption of daily ingested iron (76).

5.1 Study Strength

The following was the study strength:

- The study highlighted the high prevalence of IBS among medical students and health care professional in MUHAS that was never documented previously.

5.2 Study Limitations

The following was the study limitation:

- CD serologic test can be falsely negative in IgA deficiency, for which this study did not screen.
- Recall bias as study participants had to recall if they ever had symptoms included in the ROME IV criteria in the past months.
- Participants were recruited using online ROME IV criteria hence those with no smart phones were left out.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study has revealed a prevalence of IBS (14.5%) comparable to other studies elsewhere. Furthermore, the prevalence of CD among participants with IBS was low (1.6%) in comparison to studies done in other parts of the world. The commonest IBS subtype found was IBS-M subtype whereas most CD patients had IBS-D subtype. Age below 25 years, female gender, alcohol, and being finalist student were independently associated of IBS. IDA was uncommon whilst elevated ALAT being common among CD patients.

6.2 Recommendations

The findings of this study calls upon the following:

- Community based study to allow generalization of these findings.
- Screening of IBS in students/health care professional with Rome IV symptoms.
- A quality of life study among IBS patients to assess its impact on daily activities together with the community based study to raise awareness and control measures.

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8.0 APPENDICES

8.1 Annex I: Informed Consent Form – English Version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Consent to participate in the study on prevalence of irritable bowel syndrome, celiac disease and their manifestations among Muhimbili University of Health and Allied sciences staff and students.

Dear Sir/Madam,

My Name is Dr. Adam Gembe, a resident doctor in the department of Internal Medicine at Muhimbili University of Health and Allied Sciences (MUHAS). I am conducting a research study on prevalence of irritable bowel syndrome, celiac disease and their manifestations among Muhimbili University of Health and Allied sciences staff and students.

Purpose of the study: The aim of this study is to determine prevalence of irritable bowel syndrome, celiac disease in irritable bowel syndrome and their manifestations among Muhimbili University of Health and Allied sciences staff and students.

How to participate: Participants who are willing to participate in this study will have to sign a consent form. Short interview will be done and blood sample for investigation shall be taken.

Confidentiality: Information obtained from you will be kept confidential and shall be very helpful in this study as well as promoting better health of seropositive patients to CD.

Costs: You will not be required to pay any amount for your participation in this study.

Voluntary participation and the right to withdraw from the study: Your participation is voluntary and you have the right to withdraw from participating in this study at any time. Whatever your decision may be, it will have no effect in any way to your rights to care and treatment.

Risks: There is no risk by drawing blood although you will feel pain at the site where the needle pierces your skin for drawing blood. Also, there is a risk of introducing an infection from the skin flora if the area is not well cleaned with an alcohol swab.

Benefits: Your participation in this study will help you know about your celiac disease and irritable bowel syndrome status.

You will as well get the benefit of getting appropriate treatment as per need. IBS treatment involves symptomatic treatment depending on the predominant symptoms whereas CD involves avoidance of gluten rich meals.

I hope that the information from this research will be useful in contributing to improve the quality of care of celiac disease and irritable bowel syndrome patients and as well as tracking close family members for the risk of the disease.

Contact persons: If you have any inquiries about this study, please do not hesitate to contact:

Dr. Adam M Gembe
Principal Investigator
Muhimbili University of Health and Allied Sciences (MUHAS)
Department of Internal Medicine
P.O. Box 65001 Dar es Salaam.
Tel. 0716 009131

OR

Dr. Ewaldo Komba
Supervisor for this research.
Muhimbili University of Health and Allied Sciences (MUHAS)
Department of Internal Medicine
P.O. Box 65001 Dar es Salaam.

In case of any information about your rights as a participant in this study please contact:

The Chairperson of Research and Publication Committee

Muhimbili University of Health and Allied Sciences (MUHAS)

P.O. Box 65001 Dar es Salaam

Tel. 022-2152489

I will be grateful if you willingly agree to participate in this study.

I have understood the above information and my questions have been answered by the investigator to my satisfaction. I am willingly agree to take part in this research.

Name of the participant: _____

Signature of the participant: _____ Date: _____

Signature of Investigator: _____ Date: _____

8.2 Annex II: Informed Consent Form – Swahili Version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Ridhaa ya kushiriki katika utafiti wa kuangalia uwepo wa ugonjwa wa "celiac" na "irritable bowel syndrome" katika wafanyakazi na wanafunzi wa MUHAS

Kwa Bibi/Bwana,

Jina langu Dr. Adam Gembe, nafanya utafiti kuangalia ugonjwa wa "celiac" na "irritable bowel syndrome" katika wafanyakazi na wanafunzi wa MUHAS

Naomba ushiriki wako katika utafiti huu.

Lengo la utafiti huu ni kuangalia ugonjwa wa "celiac" na "irritable bowel syndrome" katika wafanyakazi na wanafunzi wa MUHAS

Jinsi ya kushiriki katika utafiti huu: Unaweza kushiriki katika utafiti kwa kujaza kwa hiyari yako fomu ya kuridhia kushiriki. Utafiti huu utakuwa na mahojiano kwa kutumia dodoso na vipimo vya damu.

Utunzaji wa siri: Taarifa zote zitakazochukuliwa katika utafiti huu zitakuwa ni siri na zitatunzwa kwa usiri na zitatumika katika utafiti huu ili ziweze kusaidia katika kuboresha huduma kwa wagonjwa wenye "celiac" na" irritable bowel syndrome".

Gharama za ushiriki: Ushiriki katika utafiti huu ni bure yaani hakuna gharama yeyote kwa mshiriki.

Hiyari ya kushiriki na kujitoa katika utafiti huu. Ushiriki katika utafiti huu ni wa hiyari na pia ni haki yako kujitoa katika utafiti huu muda wowote unapohisi kufanya hivyo. Maamuzi yako ya kuamua kutoshiriki au kujitoa katika utafiti huu hayataathiri haki yako ya kupata huduma na matibabu.

Madhara ya kushiriki utafiti: Hakuna madhara yeyote yatakayompata mshiriki wa utafiti huu isipokuwa tu maumivu kidogo ya sindano wakati wa kuchukua damu kwa ajili ya vipimo. Pia vimelea vya wadudu katika ngozi vinaweza ingia katika damu kama sehemu ya kutoa damu haitasafishwa sawasawa.

Manufaa ya kushiriki utafiti huu: Ushiriki wako katika utafiti huu utakuwa na faida kwako kwa kuweza kujua kama una ugonjwa wa “celiac” au “irritable bowel syndrome”. Pia, matokeo ya kipimo yatasaidia kushauri katika matibabu sahihi na vile vile kushauri ndugu wa karibu kupima endapo utakutwa na matokeo chanya ya kipimo cha “celiac”.

Mawasiliano kwa wahusika:
Kwa maswali au maoni kuhusiana na utafiti huu tafadhali wasiliana na wafuatao:

Dr. Adam Gembe
Mtafiti mkuu
Muhimbili University of Health and Allied Sciences (MUHAS)
Idara ya Magonjwa ya ndani
P.O. Box 65001 Dar es Salaam
Tel.0716 009131

AU

Dr. Ewaldo Komba
Msimamizi wa utafiti huu.
Muhimbili University of Health and Allied Sciences (MUHAS)
Idara ya Magonjwa ya ndani
P.O. Box 65001 Dar es Salaam**.**

Kwa mawasiliano zaidi kuhusiana na haki zako kwenye utafiti huu kama mshiriki, tafadhali wasiliana na:

Mwenyekiti wa tume ya tafiti na uchapishaji wa tafiti.
Muhimbili University of Health and Allied Sciences (MUHAS)
P.O. Box 65001 Dar es Salaam, Tel. 022-2152489

Nitashukuru sana kama kwa hiyari yako utaamua kushiriki katika utafiti huu.

Nimeelewa taarifa zote nilizoelezwa na mtafiti hapo juu na pia amenijibu na kunielewesha zaidi maswali niliyomuuliza. Na kwa hiyari yangu nimeridhia kushiriki katika utafiti huu.

Jina la mshiriki: _____

Sahihi au alama ya dole gumba ya mshiriki: _____ Tarehe: _____

8.3 Annex III: Rome IV Diagnostic Criteria for IBS

Phone number of study participant: _____

The following items describe the symptoms in the Rome IV criteria. Please circle your response.

1. In the last 3 months, did you have discomfort or pain anywhere in your abdomen?
   a. Yes
   b. No
2. **For women only**: Did this discomfort or pain occur only during your menstrual bleeding and not at other times?
   a. Yes b. No
3. Have you had this discomfort or pain 6 months or longer?
   a. No b. 6 month c. 6 month and longer (specify :_____)
4. Did this discomfort or pain get better or stop after you had a bowel movement?
   a. Yes
   b. No
5. When this discomfort or pain started, did you have less frequent bowel movements?
   a. Yes
   b. No
6. When this discomfort or pain started, did you have more frequent bowel movements?
   a. Yes
   b. No
7. In the last 3 months, did you have hard or lumpy stools?
   a. Yes
   b. No
8. In the last 3 months, did you have loose, mushy or watery stools?
   a. Yes
   b. No

8.4 Annex IV: English Version Questionnaire

1. Questionnaire No:……
2. AGE……
3. Sex
   a. Male
   b. Female
4. Marital status
   a. Single/divorced/widow/er
   b. Married/ Cohabiting
5. Current status
   a. Employed
   b. Student

For students only

6. Which school/institute?
   a. School of Medicine
   b. School of Dentistry
   c. School of Pharmacy
   d. School of Nursing
   e. School of Public Health and Social Sciences
   f. Institute of Allied Health Sciences and
   g. Institute of Traditional Medicine
7. Year of study
   a. Ongoing
   b. Finalist

Life style factors

8. Duration of sleep
   a. ≤ 7 hours
   b. >7 hours
9. Smoking
   a. Ever smoked
   b. Never
10. Alcohol use
    a. Ever used
    b. Never

Anthropometric measurements

9. Weight in kg ……..
10. Height in meters…….
11. BMI ……..

Other CD symptoms

12. In the last 3 months, how often did you feel bloated?
    a. All/Most of the time
    b. Some of the time
    c. Never

Laboratory investigations

13. Celiac rapid test
    a. Positive
    b. Negative
14. Full Blood Picture

    WBC _____
    HB _____
    MCV _____
    MCHC_____
    ESR _____
    ALAT _____
    ASAT ____