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Original Research Article

The Patterns of GI Cancers in Western Sudan

Mohamed Mahgoub Hassan Khalifa[1*], Tumadir Mohamed Adam Ali[1], Ahmed Abdalla Ajab Eldour[2], Galeela Abdalgader Salem[3], Hassan Mahgoub Hassan Khalifa[4], Mohamed Mergani Elkhair[5], Hussain Gadelkarim Ahmed[6, 7]

[1]Department of Histopathology and Cytology, Faculty of Medical Laboratory Sciences, University of Kordofan, El-Obeid, NK, Sudan
[2]Department of Pathology, Faculty of Medicine and Health Sciences, University of Kordofan, El-Obeid, NK, Sudan
[3]El-Obeid Histopathology Center, NK, Sudan
[4]Department of urology, El-Obeid Teaching Hospital, El-Obeid, NK, Sudan
[5]Department of General Surgery, El-Obeid Teaching Hospital, El-Obeid, NK, Sudan
[6]Prof Medical Research Consultancy Center, El-Obeid, NK, Sudan
[7]Department of Histopathology and Cytology, FMLS, University of Khartoum, Sudan

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***Corresponding author:** Mohamed Mahgoub Hassan Khalifa
Department of Histopathology and Cytology, Faculty of Medical Laboratory Sciences, University of Kordofan, El-Obeid, NK, Sudan

Abstract

***Background*:** Because GI cancer is the most common type of cancer seen every day in Sudan's clinical practice, research into this illness is critical. Our study sought to determine its epidemiological characteristics. ***Methodology*:** This is a retrospective descriptive study that includes all patients who presented with GIT tumors between January 2019 and July 2024 at the EL-Obeid Histopathology Center in North Kordofan. ***Results*:** This study included 127 individuals with GIT cancer, with 52% being male and 48% being female. Their ages varied from 20 to 98 years, with an average of 57.9±15. The age group (51–60) had the highest proportion of research subjects, with 66.7% being men, followed by the age group (61–70), with 54% being female. The most common kinds of GIT cancer were esophagus, colon, stomach, rectum, liver, small bowel, bowel rectosegmoid, and appendix, accounting for 35%, 25%, 16%, 11%, 8%, 3%, 1%, and 1%, respectively. SCC was the most common histological diagnosis, accounting for 96.6% in the esophagus, followed by AC (37.5%), 34.4%, and 21.9% in the colon, stomach, and rectum, respectively. Hepatocellular carcinoma is the diagnosis for 100% of liver cancers. AC accounted for 35.6% of all histological diagnoses across age groups, with the majority occurring in the 51-60 age range, followed by SCC at 27.6%. In all cases, 40% of others' histological grades are highly defined, with the majority developing between the ages of 61 and 70. ***Conclusion*:** The most prevalent cancers in Western Sudan were esophageal, colonic, stomach, rectal, and liver. Many incidents occur when people are over the age of 50, and they affect both men and women.

Keywords: Cancer, colon cancer, hepatocellular, carcinoma, Sudan.

INTRODUCTION

Gastrointestinal (GI) malignancies pose a significant public health concern due to their high prevalence and substantial mortality rates [1]. Currently, there is a lack of information regarding the frequency of esophageal and stomach cancers in Africa. East Africa documented 395 instances of various types of cancer during a one-year span, at a rate of 9.5 occurrences per 100,000 individuals. Gastric cancers accounted for 13% of all malignancies, while gastrointestinal cancers accounted for 38%. Studies on cancer genomes and East African cancer registries have demonstrated that stomach cancer ranks among the ten most prevalent types of cancer. Esophageal squamous cell carcinoma (SCC) is more prevalent in the eastern and southern regions of Sub-Saharan Africa. Regarding both males and females [2], A study in Sudan involved a total of 390 participants. The research group most often found gastritis (54.9%) on endoscopy, then esophagitis (42%), peptic ulcer disorders (21%), esophageal varices (13.8%), and upper gastrointestinal cancers (gastric and esophageal) (13.2%). A study determined that Sudan exhibited a greater incidence of upper gastrointestinal disorders compared to other countries. Esophageal varices and upper gastrointestinal malignancies are experiencing an upward trend in comparison to previous studies [3]. Recent studies have shown that many gastrointestinal (GI) cancers have similar risk factors, including smoking, alcohol consumption, infections, dietary habits, and obesity. The gradual changes in the prevalence of these variables may be the cause of the

rising incidence of these cancers [4]. The main reason for the unfavorable patient outcomes in GI malignancies is their unique tendency to only show symptoms at the malignant stage of the disease. Hence, it is crucial to make diligent endeavors to identify and detect this type of cancer during its first phases [5]. Primary and secondary prevention measures remain the most efficient approaches for addressing this particular group of malignancies, given their high preventability and the severity of their prognosis. This includes administering the hepatitis B vaccine to prevent liver cancer and using fecal occult blood tests for colorectal cancer screening. Additionally, it encompasses measures for managing weight in cases of esophageal adenocarcinoma and regulating tobacco and alcohol consumption in cases of esophageal squamous cell carcinoma [6]. Focused endoscopic screening and monitoring of high-risk individuals can lead to early detection of upper gastrointestinal cancers and improved patient outcomes [7]. While the clinical diagnosis relies on the individual's symptoms, the most commonly reported clinical symptoms include vomiting, blood in the stool, and stomach pain [8]. The main ways to find GI cancers are through endoscopic or CT-guided solid biopsies and the use of serum-based tumor biomarkers [1]. Histopathological diagnostics, such as liquid biopsy, is a highly effective, less invasive, and cost-effective way for diagnosing and evaluating the prognosis of gastrointestinal (GI) cancer, in addition to the standard biopsy [9]. Systemic chemotherapy, radiation, surgery, immunotherapy, and targeted therapy have all demonstrated efficacy in treating GI cancer. Therefore, the selection of treatments requires multidisciplinary care. This is particularly important due to the high prevalence of GI cancer in Sudan, making research on this disease crucial. Although the incidence of gastrointestinal cancer is steadily increasing each year, there is a dearth of cancer registry data in western Sudan pertaining to its epidemiological patterns and unknown risk factors. Furthermore, the majority of patients tend to pursue medical intervention when the condition has already progressed to an advanced degree.

MATERIALS AND METHODS

This study is a retrospective descriptive analysis that includes all patients diagnosed with gastrointestinal (GIT) tumors between January 2019 and July 2024. The data for this study was obtained from the EL-Obeid Histopathology Center, which is situated in North Kordofan, western Sudan.

Ethical Consent

The study protocol was approved by the Prof. Medical Research Consultancy Center's ethics committee.

Statistical Analysis

After organizing the collected data on a data sheet and entering it into computer software (SPSS) for analysis, we were able to determine frequencies and cross-tabulations.

RESULTS

This study included a total of 127 patients diagnosed with gastrointestinal tract (GIT) cancer. Of these, 66 (52%) were male and 61 (48%) were female. The age of the patients varied from 20 to 98 years, with an average of 57.9±15. However, we did not record the age of 22 patients. In the age range of 51–60, the majority of study subjects were males (66.7%), while the remaining were females (33.3%). The next largest frequency of study participants was in the age category of 61–70, with males accounting for 46% and females accounting for 54% of the total. The year 2023 saw the highest frequencies of gastrointestinal tract (GIT) cancer, followed by 2024, 2020, 2021, and 2022. These years represented 37 out of 127 cases (29%), 35 cases (28%), 29 cases (23%), 16 cases (12%), and 10 cases (8%) respectively, as indicated in **Table 1** and **Figure 1.**

Table 1: Distribution of the study population by year of diagnosis and age group

Variable	Males	Females	Total
Year of diagnosis			
2020	15	14	29
2021	11	5	16
2022	4	6	10
2023	17	20	37
2024	19	16	35
Total	66	61	127
Age group			
≤40 years	5	11	16
41 – 50	5	12	17
51 – 60	20	10	30
61 – 70	12	14	26
71 – 80	10	3	13
≥81	0	3	3
Total	52	53	105

As shown in **Table 2** and **Figure 2**, the most common types of gastrointestinal (GIT) cancer were in the esophagus, colon, stomach, rectum, liver, small intestine, intestinal rectosigmoid, and appendix. They made up 45 of the 127 cases (35%), 32 of the cases (25%), 20 of the cases (16%), 15 of the cases (11%), 10 of the cases (8%), 4 of the cases (3%), and 1 of the cases (1%).

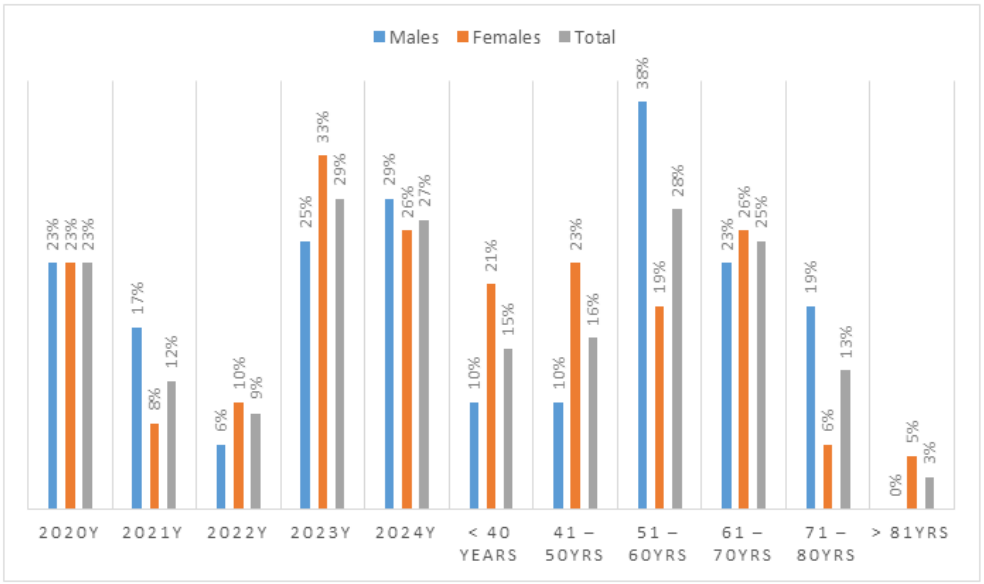

Figure 1: Distribution of the study population by year of diagnosis and age group

Table 2: Distribution of the study population by malignancy site

Variable	Males	Females	Total
Site of Malignancy			
Esophagus	22	23	45
Stomach	12	8	20
Liver	6	4	10
Small bowel	4	0	4
Colon	14	18	32
Rectum	6	9	15
Appendix	1	0	1
bowel rectosigmoid	1	0	1
Total	66	61	127

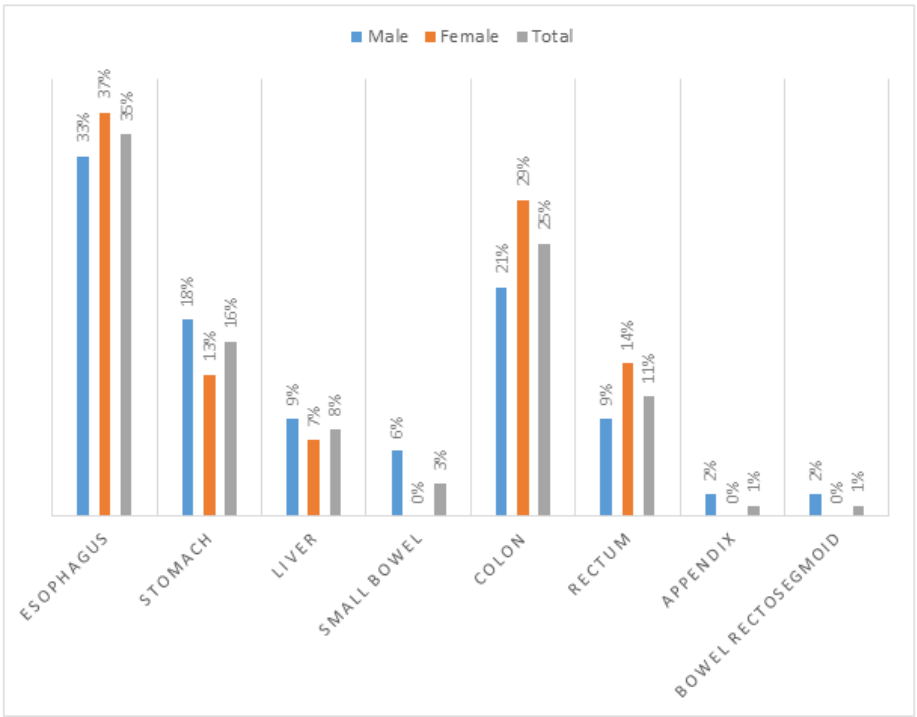

Figure 2: Descriptions of the study population by malignancy site

Among the histological diagnoses, squamous cell carcinoma (SCC) was the most prevalent, accounting for 96.6% (28 out of 29 cases) in the esophagus. Adenocarcinoma (AC) was the second most common, with 37.5% (12 out of 32 cases) in the colon, 34.4% (11 cases) in the stomach, and 21.9% (7 cases) in the rectum. **Table 3** and **Figure 3** classify all identified liver tumors as hepatocellular carcinoma.

Table 3: Histological diagnosis distribution at the malignancy site

Variable	SCC	AC	Metastatic AC	Mucinous AC	Hepatocellular Carcinoma	Others	Total
Site of malignancy							
Esophagus	28	1	0	0	0	0	29
Stomach	0	11	0	1	0	2	14
Liver	0	0	4	0	5	1	10
Colon	0	12	4	4	0	10	30
Small bowel	0	0	0	0	0	3	3
Rectum	0	7	2	1	0	1	11
Appendix	0	0	0	1	0	0	1
bowel rectosigmoid	0	1	0	0	0	0	1
Total	28	32	10	7	5	17	99

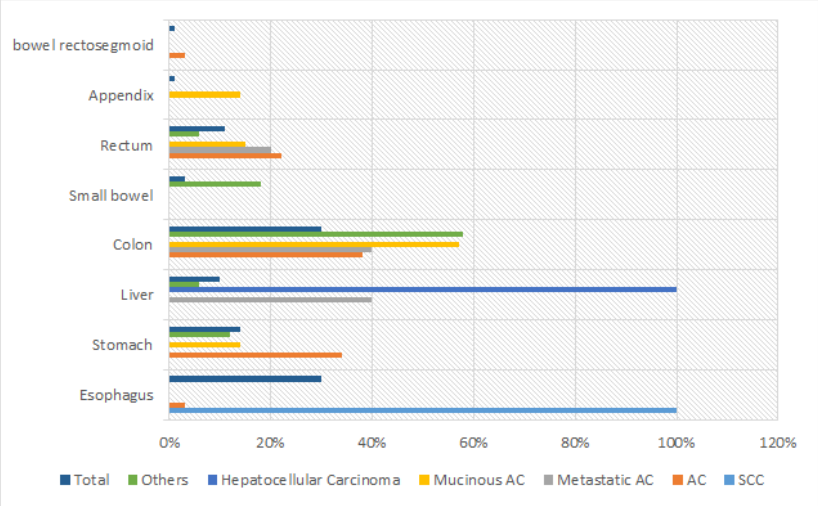

Figure 3: Description of histological diagnosis at the malignancy site

Among different histological diagnoses across age groups, adenocarcinoma (AC) accounted for 31 out of 87 cases (35.6%), with the majority occurring in the age group of 51–60. Squamous cell carcinoma (SCC) was the second most common diagnosis with 24 cases (27.6%), followed by Metastatic AC with 10 cases (11.5%), Mucinous AC with 6 cases (6.9%), Hepatocellular Carcinoma with 5 cases (5.7%), Metastatic Mucinous AC with 3 cases (3.4%), NHL with 3 cases (3.4%), and other types collectively accounting for 7 cases (8.2%). The age groups of 51–60 and 61–70 had the highest number of cases, as shown in Table 4 and Figure 4.

Table 4: Distribution of histological diagnoses among age groups

Variables	< 40 years	41 - 50	51 - 60	61 - 70	71 - 80	> 81 years	Total
Histological diagnosis							
SCC	2	2	5	10	4	1	24
AC	5	6	12	4	4	0	31
Metastatic AC	0	2	4	3	0	1	10
Carcinoid	1	0	0	0	0	0	1
Mucinous AC	0	2	4	0	0	0	6
Metastatic Mucinous AC	1	0	0	1	1	0	3
Mucinous Carcinoma	0	0	0	1	0	0	1
NHL	2	0	0	0	1	0	3
HL	1	0	0	0	0	0	1
Hepatocellular Carcinoma	0	1	2	2	0	0	5
Lymphoma	1	0	0	0	0	0	1
Metastatic papillary Carcinoma	0	0	1	0	0	0	1
Total	13	13	28	21	10	2	87

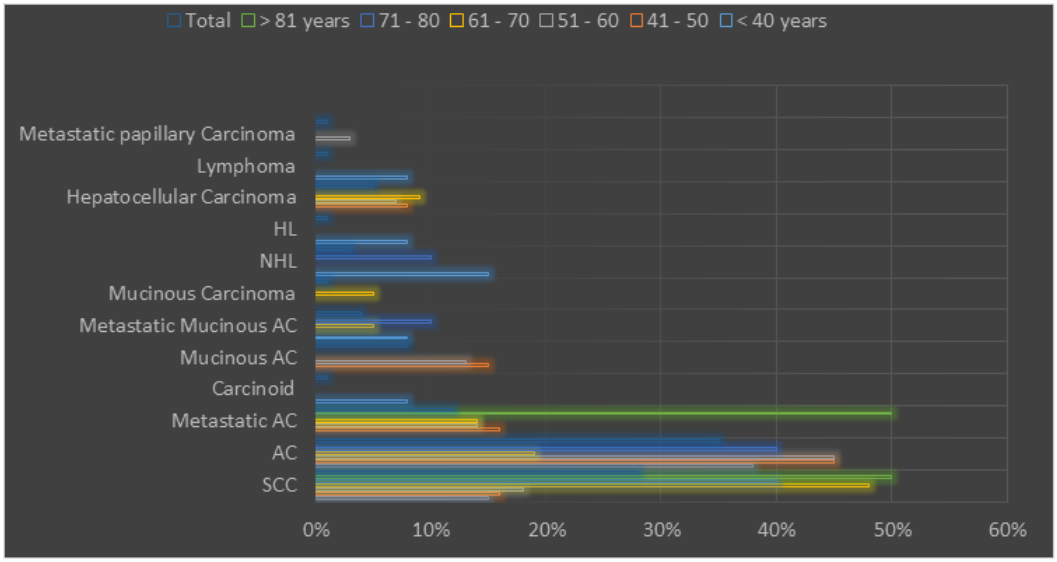

Figure 4: Description of histological diagnosis across age groups

Among all instances, 30 out of 75 (40%) were determined to be highly differentiated, which is the highest proportion among the different histological grades. We mostly observed these cases in the age category of 61–70. The age group of 71–80 predominantly discovered 23 (31%) poorly differentiated cases. The age group of 51–60 primarily observed 20 (29%) moderately differentiated cases. Table 5 and Figure 5 present these findings.

Table 5: Distribution of histological grades among age groups

Variables	< 40 years	41 - 50	51 - 60	61 - 70	71 - 80	> 81 years	Total
Histological Grade							
Well differentiated	4	5	8	9	3	1	30
Moderate differentiated	1	4	9	5	3	0	20
poorly differentiated	3	3	6	7	4	0	23
Total	8	12	23	21	10	1	75

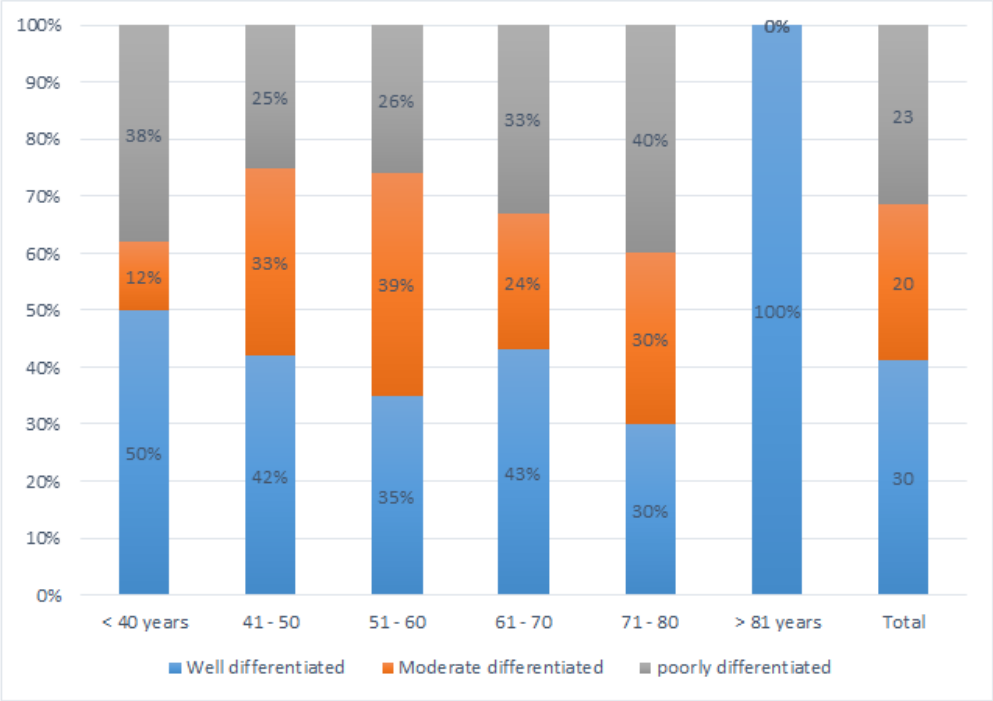

Figure 5: Description of histological grades among age groups

DISCUSSION

In Sudan's clinical practice, GI cancer is the most commonly observed type of cancer, and its prevalence is steadily rising. Furthermore, due to the paucity of cancer registry data in western Sudan, this study investigates 127 patients with GIT cancer. 52% of them are male. The participants' ages ranged from 20 to 98 years, with an average of 57.9±15. This differs from a previous study with 390 participants, who had a mean age of 50.2 years and ranged from 11 to 80 years old, with 56.4% being female [3].

According to earlier research, 54.9% of the people in the study group had gastritis. This was followed by esophagitis (42%), peptic ulcer diseases (21%), esophageal varices (13.8%), and 13.8% had upper gastrointestinal cancers (gastric and esophageal) [3]. Furthermore, another study found that the most common kinds of gut cancer were recto-sigmoid, esophageal, gastric, and hepatocellular. A recent study found that the most frequent cancer at El Obeid Hospital in Western Sudan was gastrointestinal cancer [11]. Our research revealed that the most common types of malignancies include esophageal, colon, stomach, rectal, and liver cancers. The majority of cases occur between the ages of 51 and 60, as well as 61 and 70. While colorectal cancer (CRC) is most common in the elderly, our data show that it is the third most common malignancy worldwide and the third leading cause of cancer-related death. In recent decades, its prevalence among those over 50 has declined worldwide, most likely due to improved screening [12]. Another study from Sudan indicates that pancreatic cancer is the most common GI malignancy, with colonic and gastric malignancies following at 36.5%, 26.7%, and 16%, respectively. The majority of pancreatic cancer cases (58%) originate from west Sudan and 31% from north Sudan [13]. However, these findings differ from our own research, as another study estimates stomach cancer to account for 4.9% of all cancer cases worldwide [14]. While the two most common histological subtypes, squamous cell carcinoma and adenocarcinoma, have different geographic and racial distributions [15], the eastern and southern regions of Sub-Saharan Africa have the highest rates of esophageal squamous cell carcinoma (SCC) in both men and women [2]. This conclusion is consistent with our findings that SCC was the most common: 96.6% in the esophagus, followed by AC at 37.5%, 34.4%, and 21.9% in the colon, stomach, and rectum, in that order. I also agree that EAC is more widespread in wealthier countries than in poorer countries [16]. Squamous cell carcinoma is the most common histological type on a global scale. But in Western countries, adenocarcinoma has become the most common type of esophageal cancer. This is because obesity, gastroesophageal reflux disease, and Barrett's esophagus are becoming more common [17]. Another study found that esophageal cancer affects females more than males (predominantly SCC, 89.2%). It occurs at a young age and is primarily squamous cell carcinoma type [18], which is consistent with our findings.

We found that hepatocellular carcinoma (HCC) was the cause of 100% of liver malignancies in the elderly, which is consistent with previous research showing that HCC accounts for around 90% of liver cancer cases [19]. Advanced stages of cancer detection, particularly stage III and stage IV, significantly impact the clinical outcomes and overall survival rate of patients [20]. Some cancers like Prostate cancer is a formidable malignancy due to its aggressiveness, late-stage diagnosis, and poor prognosis [21], which is consistent with our findings that the majority of cases are highly differentiated and concentrated in elderly patients above the age of 60.

Our findings revealed that the most common cancers in Western Sudan were esophageal, colonic, stomach, rectal, and liver cancers. The majority of incidents occur when people are over the age of 50, and they affect both men and women. This discovery inspires and integrates the presence of preventative programs, as well as a regional cancer registry center, in order to assess prevention, early detection, and therapies by default.

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REFERENCES

1. David, P., Mittelstädt, A., Kouhestani, D., Anthuber, A., Kahlert, C., Sohn, K., & Weber, G. F. (2023). Current Applications of Liquid Biopsy in Gastrointestinal Cancer Disease—From Early Cancer Detection to Individualized Cancer Treatment. *Cancers*, *15*(7), 1924.
2. Shikama, F., Bensen, S. P., Giraneza, R., Ndayisaba, P., Hategekimana, E., Rutaganda, E., ... & Calderwood, A. H. (2022). Upper gastrointestinal cancers in Rwanda: epidemiological, clinical and histopathological features in patients presenting to a tertiary referral hospital. *Open Journal of Gastroenterology*, *12*(10), 286-298.
3. Elhadi, A. A., Mirghani, H. O., Merghani, T. H., Mohammed, O. S., & Eltoum, H. A. (2014). Pattern of endoscopic findings of upper gastrointestinal tract in Omdurman teaching hospital, Sudan. *Sudan Journal of Medical Sciences*, *9*(2), 71-74.
4. Jardim, S. R., de Souza, L. M. P., & de Souza, H. S. P. (2023). The rise of gastrointestinal cancers as a global phenomenon: unhealthy behavior or progress?. *International journal of environmental research and public health*, *20*(4), 3640.

5. Nellore, J., Narayan, A. S., Sunkar, S., Nachiyar, C. V., Jayakrishna, T., & Peela, S. (2020). Circulating biomarkers for the early diagnosis of gastrointestinal cancers. *Critical Reviews™ in Oncogenesis*, *25*(4), 335-354.
6. Arnold, M., Abnet, C. C., Neale, R. E., Vignat, J., Giovannucci, E. L., McGlynn, K. A., & Bray, F. (2020). Global burden of 5 major types of gastrointestinal cancer. *Gastroenterology*, *159*(1), 335-349.
7. Yoo, J. W., Laszkowska, M., & Mendelsohn, R. B. (2024). The Role of Screening and Early Detection in Upper Gastrointestinal Cancers. *Hematology/Oncology Clinics*, *38*(3), 693-710.
8. Al-Thani, H., El-Menyar, A., Rasul, K. I., Al-Sulaiti, M., El-Mabrok, J., Hajaji, K., ... & Tabeb, A. (2014). Clinical presentation, management and outcomes of gastrointestinal stromal tumors. *International Journal of Surgery*, *12*(10), 1127-1133.
9. Wu, C., Zhang, J., Li, H., Xu, W., & Zhang, X. (2020). The potential of liquid biopsies in gastrointestinal cancer. *Clinical Biochemistry*, *84*, 1-12.
10. Joshi, S. S., & Badgwell, B. D. (2021). Current treatment and recent progress in gastric cancer. *CA: a cancer journal for clinicians*, *71*(3), 264-279.
11. Doumi, E. B. A., Ahmed, M. A., & Hamad, A. S. M. (2009). Pattern and incidence of cancer at El Obeid Hospital, Western Sudan. *Sudan Journal of Medical Sciences*, *4*(1). Available from: https://www.ajol.info/index.php/sjms/article/view/44874
12. Saraiva, M. R., Rosa, I., & Claro, I. (2023). Early-onset colorectal cancer: A review of current knowledge. *World journal of gastroenterology*, *29*(8), 1289-1303.
13. Ahmed, M. M., Arabi, N. A., & Mohammed, A. (2021). Gastrointestinal Malignancy in Sudanese Patients: Where we are?. *J Clin Res Oncol*, *4*(1), 1-6.
14. Bray, F., Laversanne, M., Sung, H., Ferlay, J., Siegel, R. L., Soerjomataram, I., & Jemal, A. (2024). Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*, *74*(3), 229-263.
15. Xie, Y., Shi, L., He, X., & Luo, Y. (2021). Gastrointestinal cancers in China, the USA, and Europe. *Gastroenterology report*, *9*(2), 91-104.
16. Smyth, E. C., Lagergren, J., Fitzgerald, R. C., Lordick, F., Shah, M. A., Lagergren, P., & Cunningham, D. (2017). Oesophageal cancer (Primer). *Nature Reviews: Disease Primers*, *3*(1).
17. Ahmed, M. E., Mahadi, S. I., & Ali, B. M. (2016). The surgical treatment of esophageal cancer in Sudan: A 100 consecutive cases. *International journal of surgery*, *29*, 101-107.
18. Hamad, A. M., Ahmed, M. E. K., Abdelgadir, A., & Suliman, I. B. (2017). Esophageal Cancer in Sudan: Demographic and Histopathlogical Variations. *Open Journal of Gastroenterology*, *7*(03), 124.
19. Llovet, J. M., Kelley, R. K., Villanueva, A., Singal, A. G., Pikarsky, E., Roayaie, S., ... & Finn, R. S. (2021). Hepatocellular carcinoma. *Nature reviews Disease primers*, *7*(1), 1-28.
20. Callixte, C., Sutiningsih, D., Suhartono, S., & Budijitno, S. (2023). Stage at Diagnosis of Stomach Cancer Amongst Selected East African Countries: A Mini Systematic Review. *Jurnal Epidemiologi Kesehatan Komunitas*, *8*(2), 131-136.
21. Luo, W., Wang, J., Chen, H., Ye, L., Qiu, J., Liu, Y., ... & Zhang, T. (2023). Epidemiology of pancreatic cancer: New version, new vision. *Chinese Journal of Cancer Research*, *35*(5), 438.