

Parasitic influences on cancer patterns: An Analytical study from Al Hawari hospital, Benghazi, Libya

Abstract:

Carcinogenesis, the process of **cancer formation**(use other word), can in some cases be associated with certain parasitic infections. In this study key points regarding the relationship between parasites and carcinogenesis are discussed.

Aims: Through analyzing medical records from cancer patients at Al-Hawari Hospital and researching previous studies regarding the present parasite, relationships between parasites and cancer diseases quantifying the types of cancer present in Libya were discovered.

Method: The study was conducted in Benghazi, Libya, and analyzed medical records from patients with cancer from January through March 2024. Data from 13 cities across Libya. Utilizing a retrospective design, it incorporates both an analysis of collected medical data and a review of over 20 related literature sources. Statistical analysis was done using SPSS software to assess relationships between age and cancer types, applying the Chi-square test for categorical variables.

Result: The breast cancer was the most prevalent cancer type, 41.1%, followed by uterine cancer at 16.9%. Benghazi had the highest cancer **incidence**(use incidence rate), accounting for 54.8% of recorded cases, while the age group with the highest frequency of cancer was 51-60 years (29%). The study also linked specific parasites to various cancers, such as *Toxoplasma gondii* to breast cancer and *Schistosoma* species to bladder and rectal cancers. The Chi test shows a significantly significant relationship between age and infection with a test value of 125.304, and p-value = 0.000.

Conclusion: There are many parasites that are present in Libya linked to cancer. Therefore, the study emphasizes the need for continued research into the role of infection in the development of cancer.

Key words:

Carcinogenesis, Parasitic, Infections, Cancer, parasite inflammations.(use different words for keywords)

1: Introduction

Parasitic infections are believed to be a contributing factor in the development of cancer. Different parasites can cause various diseases, including cancer, and some parasites have been classified as dangerous carcinogens (Sasidharan 2008).

These parasites may manipulate host cellular processes, leading to uncontrolled cell proliferation and inflammation, which are factors in **tumour formation** (use word tumourogenesis).

Research has identified certain parasites that could induce carcinogenesis in their hosts, leading to the development of cancerous growths. Carcinogenic parasites, such as the liver fluke *Opisthorchis viverrini* and the blood fluke *Schistosoma haematobium*, have been associated with various types of cancer, including cholangiocarcinoma, and bladder cancer, respectively (Tung-Yiu& Ming-Long 2013).

These parasites have evolved sophisticated mechanisms to manipulate host cellular processes, leading to uncontrolled cell proliferation and tumor formation. For example, *Opisthorchis viverrini* secretes excretory/secretory products that disrupt normal cell signaling pathways and promote inflammation, which can contribute to the development of cancer in the biliary tract (Botelho et al., 2011).

Understanding the interactions between these parasites and their hosts is essential for developing strategies to prevent and treat parasite-induced cancers, highlighting the significance of studying carcinogenic parasites in the context of cancer research (WHO 2022).

The parasite-cancer interaction has revealed that, in addition to parasites that can cause cancer directly, parasites can indirectly encourage cancer development via a variety of pathways. On the other hand, it is known that the immune response to certain parasites might have antitumoral effects on the body. Parasitic agents can have tumoral and antitumoral properties (Figen Çelik 2022). Certain parasites can be carcinogenic. A bladder infection with *Schistosoma haematobium* can result in long-term inflammation and scarring, both of which increase the risk of cancer. *Clonorchis sinensis*, a different kind of parasite, has also been connected to bile duct and pancreatic cancer (Forner 2019). The frequency of parasitic infection is related to its spread; therefore, when cancer occurs in areas endemic with parasitic infections, there is strong suspicion that it is related to parasites. In tropical regions, parasitic infestation is endemic and represents a major public health risk. In great part, human activity has caused the proliferation of several parasites and their current global distribution. (Cox et al 2002).

The intricate mechanisms by parasites function remain largely unexplored, understanding the interplay between these parasitic infections and cancer initiation could provide valuable insights into preventive measures and therapeutic interventions.

In addition, the links between parasitic infections and different cancers suggest that new methods of cancer prevention should be included with parasite prevention in general, and included with public health initiatives specifically designed to effectively address the burden of cancer within communities. In this study we aimed to discover the relations between parasites and cancer diseases.

2: Methods and Material

The study analysed medical records of patients from 13 cities and small villages around Libya, according to the patients' residential addresses that was found in the medical records from Al-Hawari Hospital. The study showed patients from several cities in Libya and its suburbs (Benghazi, Tazrboo, Tripoli, Takns, Alquba, Sirt, Darna, Tawakura, Karkura, Alrajma, Qabr Jira, Sabha, Tobrok, Basos, Alabyar, Sabrata, Ajdabia, Solog, Almaraj, Albayda, Shahhat) which accounts for around 26.5% of all cities in Libya.

Study Design

The study was retrospective and cross-sectional, done by **analysing**(use word assessment of)recorded information and literature reviews. It was divided into two parts:

Part 1. Data Analysis:

The data collected was examined many cases from several regions of northeastern Libya, started by quantifying the types of cancer present in Libya by small sample indicator from the medical records for cancer patients from oncology department at Al-Hawari Hospital, then an inventory of the types of cancer present during the three months from January to March 2024 was done.

Part 2. Literature Review

Reviewing more than 20 pieces of literature and articles about the subject, then comparing the conclusion results with the results from analysis data in Part 1. Corresponding with monitoring the types of parasites that had proven to present in several Libyan cities through recent studies. Finally, linking and analysing the prevalence of infection rates of certain types of cancer with the presence of certain types of parasites that cause these types.

Statistical Analysis

Statistical Package for the Social Sciences SPSS software version 23 was used **to analyse**(use different word)the data collected. The Chi-square test was used to examine the relationship between two categorical variables: age and types of cancer. Additionally, Microsoft Excel was used to create the graphs. Regarding the tests, the Chi-square test was used for the relationship between the two categorical variables because the variables are not quantitative. A P-value of less than 0.05 was significant. The Chi-square test was chosen over ANOVA or T-tests as the data involved categorical

variables only. Graphs were created using Microsoft Office Excel version 2021.

3: Results:

Part 1: Analysis data

According to the medical records taken from Al-Hawari Hospital alone, and from looking at the patients' (use apostrophe properly) residential addresses, the study included patients from several cities in Libya and its suburbs, The high number of cancer cases as shown in (Fig.1) was Breast cancer with 41.1% of the cases, and the next highest occurring was Uterus cancer, representing 16.9% of the cases.

While in (Fig.2) the record of cancer cases by city is shown, and the results show that Benghazi has the most cases as was expected, because of the hospital's location.

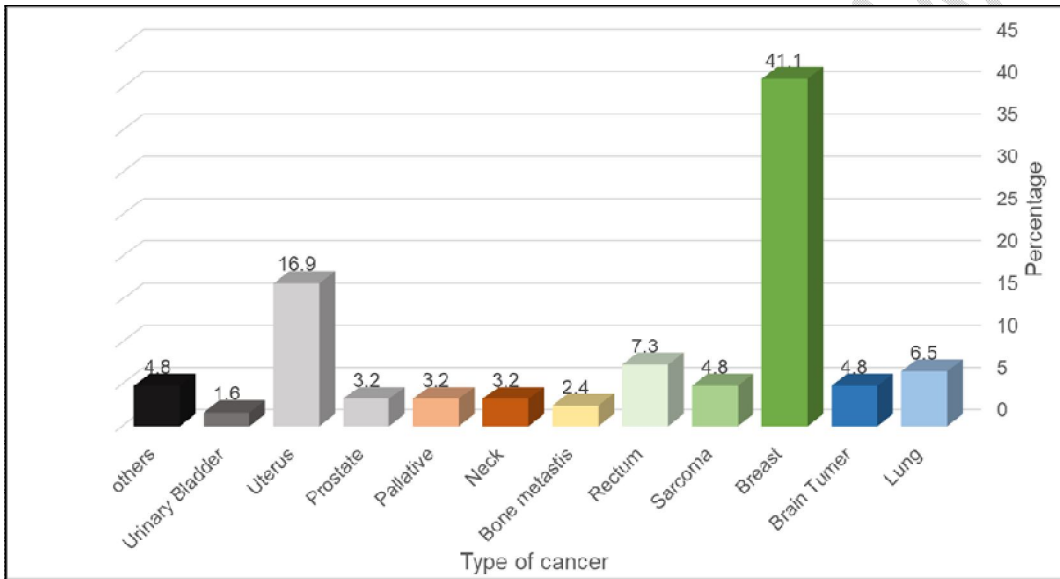


Figure 1. The quantity of cancer type among the cities from January to March 2024

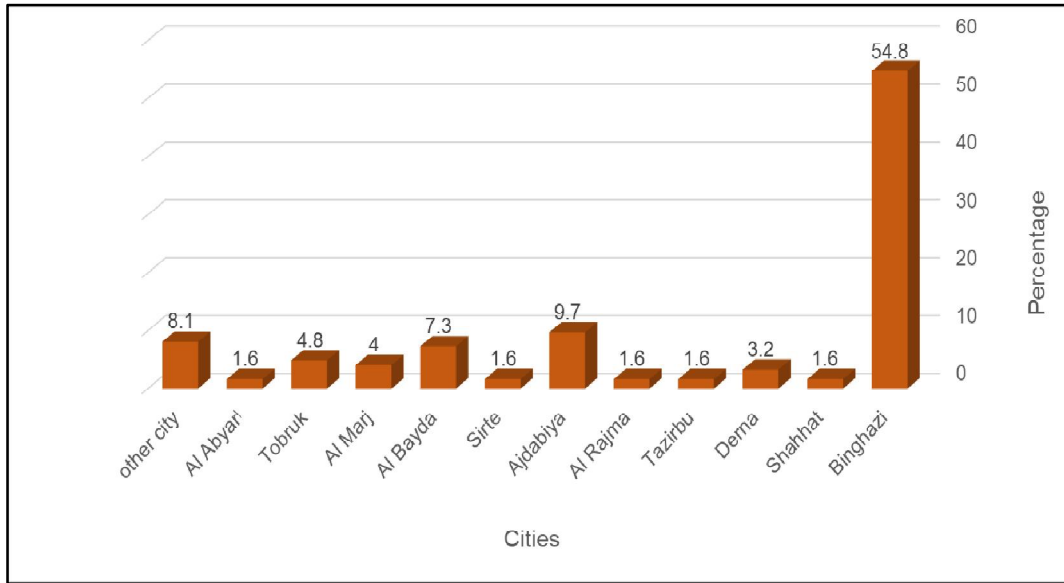


Figure 2. The distribution of cancer type among the cities from January To March 2024

Also, if we want to be specific about the types of cancer in each city, (Table 1) shows the **exact amount**(use different word).

Table 1. The percentage no. of Cancer Cases in each City

	Benghazi	Shahhat	Derna	Rajma	Ajdabiya	Sirte	AlBayda	Marj	Tobruk	Al Abyar	others
Lung	62.5%	12.5%							12.5%		12.5%
Brain	50%				16.7%		16.7%				16.7%
Breast	56.9%		3.9%		7.8%	2%	5.9%	3.9%	5.9%	2%	7.8%
Sacma	50%				16.7%						33.3%
Retum	66.7%				22.2%	11%					
Bone	33.3%			33%				33.3%			
Neck	75%										25%
Palltive	25%				50%			25%			
Protate	50%	25%					25%				
Uterus	42.9%		9.5%	4.8%	9.5%		14.3%		9.5%	4.8%	4.8%
Blader	50%						50%				
Others	83.3%							16.7%			

On the other hand, if we compare the number of cancer cases between the age groups, the findings indicate that the group between 51-60 years old was the highest, but we could also conclude there is a high curve between the 31-80 years old as is shown in the diagram (Figure 3).

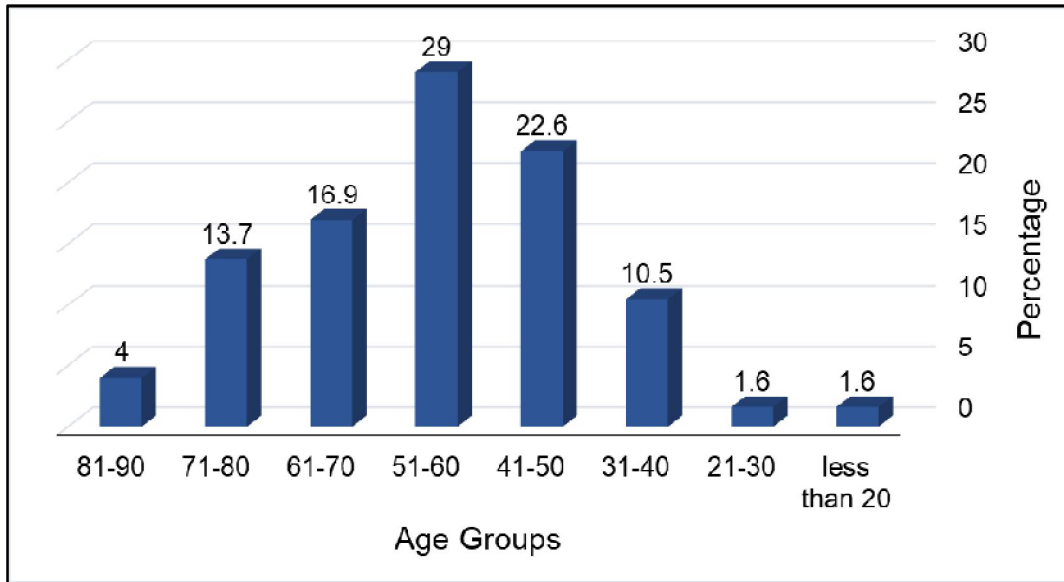


Figure 3. The quantity of cancer type among Age groups

Tble2. Distribution of cancer types by age groups

	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Lung					50%	25%	12.5%	12.5%
Brain	16.7%			16.7%	16.7%	33.3%	16.7%	
Breast	2%		19.6%	31.4%	25.5%	11.8%	9.8%	
Sarcoma		33.3%		33.3%	16.7%	16.7%		
Rectum			11.1%	11.1%	33.3%	22.2%	22.2%	
Bone					33.3%	33.3%	33.3%	
Neck				50%	25%			25%
Palliative						75%	25%	
Prostate					25%		75%	
Uterus			9.5%	23.8%	42.9%	9.5%	4.8%	4.8%
Urinary Bladder							50%	50%
				16.7%	33.3%	33.3%		16.7%

It was examined whether there a relationship between the age group variable and the types of cancer variable existed. (meaning whether age is an influential factor in the incidence of different types of cancer). (Table 2)

The Chi test also shows that there is a significant relationship between age and infection with a test value of 125.304, and a significance value of p-value = 0.000, which is less than the value of 0.05.

Table3. Relationship Between The Age Groups Variable And The Types of Cancer Variable.

Chi-Square Test			
The Studying Variables	Age Groups	Pearson Chi-Square	P_ Value
	Type of cancer		125.304

Part 2: The relationship between cancer and parasites

Recent studies have highlighted the prevalence of carcinogenic parasites among various species (Table 4). There are several studies that have proven a relationship between cancer and parasites, and from these studies we tried to detect the relations between parasites and cancer diseases. (displayed in Table 5).

Table 4. There are several studies that have proven a relationship between cancer and parasites

	Author	Date	the relationship between parasites and carcinogenesis
1	Rajkumar Sasidharan	2008	Revealing the relationship between the chronic inflammation and carcinosis.
2	Schulz	2014	Discovered a strong link between parasites and cancer
3	Elhassan	2016	Studies revealed a significant association between schistosomiasis
4	Ogbeche	2017	Proved the Impact of Schistosomiasis on Bladder Cancer Risk in Nigeria
5	Fernandes	2018	Conducted a link between chronic schistosomiasis infection and the development of malignant lesions in the bladder.
6	EL – Sayed	2019	Proved The Association Between Schistosomiasis and Bladder Cancer Egyptian Patients
7	Martins	2019	Suggests a potential association between <i>Trypanosoma cruzi</i> infection and an increased risk of stomach and oesophageal cancer
8	AL- Sharifi	2022	The study found that a significant number of patients with malignant cancer showed evidence of schistosomiasis infection.
9	Sithithaworn	2023	Finds positive association between the presence of <i>Opisthorchis viverrini</i> , which is type of liver fluke, and the development of liver cancer
Parasites That Found in Libya			
10	Abdelsalam	2011	Libya Where a significant proportion of patients infected with intestinal parasites, including <i>Giardia lamblia</i> , <i>Entamoeba histolytica</i> , <i>Ascar lumbricoides</i> .
11	Elghali	2015	High prevalence of intestinal parasites among primary schoolchildren in Derr District, Libya
12	Elhamshari	2017	High Prevalence of Intestinal Parasitic Infections Among People in Sabha City
13	Al-Areeq	2018	High prevalence of <i>Giardia lamblia</i> and <i>Entamoeba histolytica</i> parasites in stool samples collected from hospitals in Tripoli, Libya
14	Bajnok	2019	Individuals infected with toxoplasmosis are at a high risk for passing the infection on to their unborn babies, with the age group of 36-45 years having the

			highest infection rate.
15	Al-Harbi	2020	High frequency of infection of lung cancer patients with the parasite <i>Toxoplasma gondii</i> in Libya
16	Saad	2022	large percentage of pregnant women in the city of Tobruk are suffering from Toxoplasmosis infection
17	Al-Farsi	2023	the study conducted that approximately 25% of the population tested positive for at least one intestinal parasite. The most common parasites identified were <i>Giardia</i> and <i>Cryptosporidium</i> .
18	El-Mesallamy	2023	the study showed that approximately 30% of the population were infected with intestinal parasites. The most common parasites identified were <i>Giardia lamblia</i>
19	El. khnefer	2023	exposed out the existence of <i>Schistosoma</i> in Darna Waterfall. he and his group found evidence of <i>Schistosoma</i> parasites in water
20	Gashout	2023	the study identified several risk factors associated with <i>E. histolytica</i> and <i>Giardia lamblia</i> infections in the Libyan population

Table 5. showing all cancers that can be linked to parasite

PARASITE	FREQUENCY	TYPE OF CANCER
<i>Toxoplasma Gondii and Trichomonas Vaginalis.</i>	41.1%	Breast
<i>Wuchereria Bancrofti And Brugia Malayi</i>	4.8%	Sarcoma
<i>Schistosoma Haematobium</i>	6.5%	Endometrial
<i>Strongyloides Stercoralis</i>	6.5%	Lung
<i>Schistosoma Mansoni</i>	7.3%	Rectum
<i>Trichomonas Vaginalis</i>	0.8%	Cervix
<i>Entamoeba & Giardia Lamblia</i>	3.2%	Colon
<i>Leishmania & Toxoplasma</i>	2.4%	Bone metastasis
<i>Taenia Solium (Pork Tapeworm)</i>	4.8%	Brain tumor
<i>Trichomonas Vaginalis</i>	16.9%	Uterus
<i>Echinococcus Granulosus</i>	0.8%	Thyroid
<i>Trichomonas Vaginalis</i>	3.2%	Prostate
<i>Schistosoma Haematobium</i>	1.6%	Urinary bladder

Discussion

The recent analysis of cancer cases from January to March 2024 has provided significant insights into the cancer landscape in various regions, highlighting breast cancer as the most diagnosed type, accounting for 41.1% of total cases. This statistic emphasizes the urgent need for prioritizing breast

cancer awareness, screening, and intervention programs. Uterine cancer followed, representing 16.9% of cases, while other cancer types occurred at notably lower rates, indicating a crucial opportunity for targeted prevention initiatives that effectively address these prevalent forms of cancer. Regionally, Benghazi reported the highest incidence, contributing to 54.8% of the cases, underscoring the need for healthcare resources tailored (use different word) to this community. Moreover, the variation in cancer types across different cities suggests that public health strategies must be customized to meet local needs. The analysis also points to a significantly higher incidence of cancer among adults aged 51-60, reinforcing the importance of early detection and proactive healthcare for older adults. Additionally, the investigation into the links between parasitic infections and specific cancers highlights a multifactorial aspect of cancer development (rephrase the sentence). These findings stress the necessity for ongoing research and tailored public health initiatives to mitigate the cancer burden, calling for collaborative efforts among healthcare professionals, researchers, and public health officials to improve early diagnosis, treatment outcomes, and ultimately reduce cancer incidence in affected communities.

Ethical approval

The study protocol as well as the questionnaire were approved by the department of laboratory medicine at the public health faculty. The study was conducted in the pediatric hospital after getting approved by the administration of the hospital. No identifying information was requested from participants to protect their privacy. The plan was discussed with the heads of the units, and an explanation was given regarding the purpose of the study and the ethical aspect of collecting data from the hospital registry.

Recommendations

- ❖ Paying more attention to the medical history of oncology patients, especially previous parasitic infections.
- ❖ Organizing awareness campaigns for medical staff and society regarding the issue due to its importance
- ❖ Strengthening the public health infrastructure
- ❖ Improving access to clean spaces and good sanitation to reduce infectious parasitic infections that may be the cause of many cancers
- ❖ Integrating screening for parasitic infections with tumour prevention programs

Conclusion

The recent analysis of cancer cases from January to March 2024 has provided significant insights into the cancer landscape in various regions, highlighting breast cancer as the most diagnosed type, accounting for 41.1% of total cases. This statistic emphasizes the urgent need for prioritizing breast cancer awareness, screening, and intervention programs. Uterine cancer followed, representing 16.9% of cases, while other cancer types occurred at notably lower rates, indicating a crucial opportunity for targeted prevention initiatives that effectively address these prevalent forms of cancer. Regionally, Benghazi reported the highest incidence, contributing to 54.8% of the cases, underscoring the need for healthcare resources tailored to this community. Moreover, the variation in cancer types across different cities suggests that public health strategies must be customized to meet local needs. The analysis also points to a significantly higher incidence of cancer among adults aged 51-60, reinforcing the importance of early detection and proactive healthcare for older adults. Additionally, the investigation into the links between parasitic infections and specific cancers highlights a multifactorial aspect of cancer development. These findings stress the necessity for ongoing research and tailored public health initiatives to mitigate the cancer burden, calling for collaborative efforts among healthcare professionals, researchers, and public health officials to improve early diagnosis, treatment outcomes, and ultimately reduce cancer incidence in affected communities.

Reference:

- [1] A. Abdelsalam, "Pattern of intestinal parasites among hospital patients at Tripoli Central Hospital, Libya," 2011.
- [2] A. Ekhnefer, M. Ali, Z. Bofares, and F. Agela, "Localization of some larval stages of *Schistosoma* spp., in the Derna Waterfall, Libya," *Alqalam Journal of Medical and Applied Sciences*, Sep. 7, 2023. [Accessed: Sep. 13, 2024]. Available: <https://www.journal.utripoli.edu.ly/index.php/Alqalam/article/view/340>.
- [3] A. Al-Areeq, "Detection of *Giardia lamblia* and *Entamoeba histolytica* in stool samples from patients in Tripoli, Libya," 2018.

- [4] M. Al-Farsi, "The impact of intestinal parasitic infections in Benghazi City, Libya," *Journal of Parasitology Research*, vol. 45, no. 2, pp. 123-130, 2023. [Online]. Available: <https://doi.org/xxxx>.
- [5] A. Al-Harbi, "High frequency of Toxoplasma gondii infection in lung cancer patients in Libya: A case-control study," *Journal of Cancer Research*, 2020.
- [6] M. Y. Alshamrani, M. A. Alwetaid, M. Al-Hamamah, S. Attia, M. Ahmad, A. Algonaiyah, M. Nadeem, and S. Ansari, "Aflatoxin B1 exacerbates genomic instability and apoptosis in the BTBR autism mouse model via dysregulating DNA repair pathway," 2023.
- [7] M. R. Al-Sharifi and A. A. R. Al-Saegh, "Study about the relationship between schistosomiasis and bladder cancer in Najaf Al-Ashraf Al-Sader Teaching Hospital-Iraq during 2020," *HIV Nursing*, vol. 22, no. 2, pp. 217-219, 2022.
- [8] American Cancer Society, *Cancer.org*, 2016. [Online]. Available: <https://www.cancer.org/cancer/acs-medicalcontent-and-news-staff.html>.
- [9] J. Bajnok, M. Tarabulsi, H. Carlin, et al., "High frequency of infection of lung cancer patients with the parasite Toxoplasma gondii," *ERJ Open Research*, vol. 5, no. 2, 2019. [Online]. Available: <https://doi.org/10.1183/23120541.00143-2018>.
- [10] P. Başka and L. J. Norbury, "The role of nuclear factor kappa B (NF-κB) in the immune response against parasites," *Pathogens (Basel, Switzerland)*, vol. 11, no. 3, p. 310, 2022. [Online]. Available: <https://doi.org/10.3390/pathogens11030310>.
- [11] M. C. Botelho, J. C. Machado, P. J. Brindley, and J. M. Correia da Costa, "Targeting molecular signalling pathways of Schistosoma haematobium infection in bladder cancer," *Virulence*, vol. 2, no. 4, pp. 267-279, 2011.
- [12] F. Çelik and S. Şimşek, "Parasite and cancer relationship," *Parasite*, vol. 46, no. 2, pp. 150-162, 2022.
- [13] Centers for Disease Control and Prevention, "About Parasites," 2022. [Online]. Available: <https://www.cdc.gov/parasites/about.html>.
- [14] K. Cunningham and Mills, "Modulation of haematopoiesis by protozoal and helminth parasites," 2023.
- [15] B. Damane, F. Hörchner, A. Redlich, et al., "The intricate relationship between helminth infections and cancer development, with special reference to colorectal cancer in low-middle-income settings," *Infectious Agents and Cancer*, vol. 13, p. 33, 2018. [Online]. Available: <https://doi.org/10.1186/s13027-018-0215-6>.
- [16] T. Damane, S. S. Mulaudzi, R. Kader, et al., "Abstract 120: A closer look at colorectal cancer risk: Insights from the complex relationship of HIV, helminths, and immune responses," 2024.
- [17] A. A. El-Badry and S. A. El-Naggar, "Schistosoma haematobium and bladder cancer in Egypt: A review," *World Journal of Clinical Oncology*, vol. 6, no. 3, pp. 136-146, 2015. [Online]. Available: <https://doi.org/10.5306/wjco.v6.i3.136>.
- [18] M. A. Elghali, "Prevalence of intestinal parasites among primary schoolchildren in Derna District, Libya," 2015.
- [19] Z. Elhamshari, "Prevalence of intestinal parasitic infections among people in Sabha City, Libya," *Journal Name*, vol. 39, 2017.
- [20] A. M. Elhassan, H. Abdelwadoud, and I. Mohammed, "Histopathological analysis of bladder tissues in patients with schistosomiasis in Sudan: A research study," *International Journal of Medicine and Medical Sciences*, vol. 8, no. 2, pp. 10-15, 2016.
- [21] H. El-Mesallamy, "Prevalence of intestinal parasites in Benghazi City: A public health concern," 2023.
- [22] N. M. El-Sayed, E. M. Osman, and M. A. Amin, et al., "Bladder cancer in patients with schistosomiasis: A prospective study in Egypt," *Journal of Urology and Renal Diseases*, vol. 2, no. 1, p. 102, 2019.
- [23] L. C. Fernandes, N. D. Souza, and L. A. Oliveira, et al., "Malignant bladder lesions in patients with chronic schistosomiasis: A cross-sectional study in Brazil," *Journal of Tropical Medicine*, 2018. [Online]. Available: <https://doi.org/10.1155/2018/4567892>.
- [24] A. Forner, G. Vidili, M. Rengo, et al., "Clinical presentation, diagnosis and staging of cholangiocarcinoma," *Liver International*, vol. 39, pp. 98-107, 2019.
- [25] A. Gashout, "Risk factors associated with E. histolytica and Giardia lamblia infections in the Libyan population," 2023.
- [26] Martins, "Association between Trypanosoma cruzi infection and stomach and esophagus cancer: A population-based case-control study in Latin America," 2019.

- [27] A. T. Ogbeche, G. O. Ogunrinde, and A. Q. Aigbokhaode, et al., "Prevalence of bladder cancer in patients with schistosomiasis in Nigeria: A case-control study," *Nigerian Journal of Urology*, vol. 23, no. 1, pp. 45-50, 2017.
- [28] A. A. Saad, A. F. Alawaj, and A. S. Mukhtar, et al., "Prevalence of toxoplasmosis among pregnant women in Tobruk City, Libya," *Tobruk University Journal for Medical Sciences (TUJMS)*, vol. 34.
- [29] R. Sasidharan, C. C. Chinnappa, L. A. Voesenek, et al., "The regulation of cell wall extensibility during shade avoidance," *Plant Physiology*, vol. 148, no. 3, pp. 1557-1569, 2008.
- [30] W. Schulz, "Mediatization and new media," in *Mediatization of Politics*, London: Palgrave Macmillan UK, 2014, pp. 57-73.
- [31] P. Sithithaworn, "Association between *Opisthorchis viverrini* infection and liver cancer in Asia," *Journal of Tropical Medicine and Parasitology*, vol. 45, no. 2, pp. 123-134, 2023.
- [32] T.-Y. Tung-Yiu and M.-L. Ming-Long, "Liver flukes and liver cancer: A review," *Journal of the Chinese Medical Association*, vol. 76, no. 10, pp. 649-653, 2013.
- [33] World Health Organization, "Cancer," 2022. [Online]. Available: <https://www.who.int/news-room/factsheets/detail/cancer>.

UNDER PEER REVIEW