

PUBLIC AWARENESS OF ACUTE LEUKEMIA IN A SAMPLE OF IRAQI PEOPLE

Shams Salah Mahdi^{1*}, Moamar Shakir Mahmood², Shather Salah Mahdi³, Shaddan Salah Mahdi⁴

¹ Central public health laboratory, Ministry of Health, Baghdad, Iraq
(shamsmahdimd@gmail.com)

² College of Dentistry, Al-Iraqia University, Baghdad, Iraq

³ Al-Numan General Hospital, Ministry of Health, Baghdad, Iraq

⁴ Baghdad College of Medical Sciences- Baghdad, Iraq

ABSTRACT

Introduction: Acute leukemia is a rapidly progressing hematologic malignancy that requires timely diagnosis and treatment. Public awareness and knowledge of acute leukemia, including its risk factors, symptoms, and treatment options, are critical for early detection and improved outcomes, and research in this area is limited in Baghdad, Al-Rusafa. This study aimed to assess the public's awareness and knowledge of acute leukemia, including an understanding of its risk factors, symptoms, and role of treatment, prognosis, preventive measures, and metastasis. **Methods:** A cross-sectional survey was conducted among 1000 individuals in Baghdad, Al-Rusafa. A structured questionnaire collected data on participants' demographics, awareness, and knowledge of acute leukemia. Descriptive statistics and inferential analyses were performed to assess the level of awareness. **Results:** A total of 1000 participants completed the survey. The main participants were females. The majority of females and males were of non-university level education. The local community was the main source of participants' knowledge. Environmental factors were the major risk factors reported by the participants. The majority of participants believed in the poor prognosis for acute leukemia (AL), but also the majority believed in the significant role of treatment. Poor knowledge was found regarding preventive measures and metastasis. **Conclusion:** The study reveals a substantial gap in public awareness and understanding of acute leukemia, its risk factors, symptoms, prognosis, treatment, prevention, and metastasis. These findings underscore the need for targeted public health education initiatives to improve awareness, ultimately promoting early detection and outcomes would be better for individuals at risk of acute leukemia.

Keywords: Awareness, Acute Leukemia, Public Health, Community Health Care, Iraq

INTRODUCTION

Leukemia is a blood disorder of the uncontrolled proliferation of blood cells. It can be acute or chronic. Acute leukemia is where uncontrolled proliferation affects the immature blood cells. Several genetic and environmental factors have been implicated in the pathogenesis of acute leukemia, but its cause is still unknown (Tebbi 2021). Leukemia was classified as the 13th most common disease in the world by a GLOBOCAN study in 2018, with the mortality rate rising by 17% in that year (Barrington-Trimis et al. 2017). In children aged 1-14 years, leukemia, is considered the third most common cause of death (Ibrahim et al., 2023). The different cases of acute leukemia can be classified according to the cells of origin, myeloid or lymphoid. Acute myeloid leukemia AML has been observed to occur more frequently in aged populations and males than females (Ifeanyi 2020). Whereas acute lymphoblastic leukemia ALL occurs more frequently in children, being the major cause of cancer and death from cancer in the pediatric age group (Hailu et al., 2023). This disease carries a profound impact on patient's lives and healthcare systems, with an especially significant challenge if the diagnosis is delayed as it will lead to a poor prognosis; thus, public awareness and knowledge about the disease remains a necessity (Gómez-De León et al. 2023). Acute leukemia diagnosis requires the morphological examination of blood and bone marrow slide smears stained with May-Grünwald-Giemsa or a Wright-Giemsa stain using a microscope. Flow cytometer, conversely, is used to determine lineage involvement of newly diagnosed cases, along with genetic studies which are mandatory for evaluating acute leukemia suspected cases (Döhner et al., 2010, Inaba & Pui, 2021). In Iraq, according to the Annual Cancer Registry of 2022 leukemia has been the seventh top cancer in males and the eighth in females (Cancer Registry 2022). ALL was found to be the most common type of leukemia in two studies, one from Kerbala (Mjali et al., 2019), and the other one from Sulaymaniyah (Karim et al., 2016). This research focused on various aspects that might improve AL awareness, which means by default, an early approach to healthcare providers and early diagnosis. This research included demographic data of participants and their level of education, their knowledge of the disease's clinical features, risk factors, prognostic factors, and role of treatment and its complications. As diabetes DM, hypertension HT, and their related ischemic heart disease are documented to be the main chronic illnesses in the Iraqi population- their effect on AL prognosis was also asked about (Hussain & Lafta, 2019), while the role of HT has not been documented yet, up to our knowledge, DM and glycemic control have shown no poor prognostic effect on AL in a cohort study by Wiedmeier et al. (Wiedmeier et al., 2021).

This study aims to assess public awareness of acute leukemia (AL) in a sample of Iraqi people, focusing on clinical features, risk factors, prognosis, and treatment options. It seeks to identify knowledge gaps, examine the role of demographic factors like age and education, and explore perceptions of chronic illnesses such as diabetes and hypertension on AL prognosis. The findings will guide targeted educational efforts to improve early detection and outcomes.

METHODS

Study Design: This is a cross-sectional survey conducted to evaluate public awareness of AL among a sample of Iraqi people. The survey was designed to capture demographic information and knowledge about various aspects of AL, including risk factors, clinical features, prognosis, treatment, complications, and comorbid conditions' impact.

Data collection: a structured survey was administered to the population who came to hospitals in the Medical City Complex and the nearby area of Bab Al-Muatham. The survey was conducted over 2 years (December-2021-December-2023). During this period, 1000 individuals were approached. Verbal consent was obtained. This sample size was chosen to ensure sufficient statistical power to increase the reliability of the study.

Inclusion Criteria: adults aged 16 years and above, residents of Baghdad, and individuals providing verbal consent.

Exclusion criteria: Individuals offered no consent.

Data Variables: In this study: 1) demographic information collected: age, gender, education level, marital status. 2) source of knowledge about AL: whether from media, internet, social community, or if they did not know about the disease. 3) knowledge about AL risk factors, clinical features, prognosis and prognostic factors, role, and complications of treatment, prevention, and impact of comorbid conditions HT, DM, and autoimmune diseases. 4) whether a participant is personally diagnosed with AL or had an acquaintance diagnosed with the disease. These survey variables were conducted in the local language of the population. The survey was initially conducted in Arabic, the main native language of the study population, and then translated into English in order to be applicable in analysis programs and the reporting in an article.

Ethical considerations: ethical approval was obtained from the Arab Board of Clinical Pathology. Participants' confidentiality was maintained, and the collected data was securely stored and only accessible to the research team.

Statistical analysis: A descriptive statistical analysis was performed using IBM SPSS (version 23). (IBM Corp., Armonk, NY). Data were presented in simple measures of descriptive statistics, frequency, and percentage.

RESULTS

Demographic features of the research population: Female individuals represented 64% of all participants, and males were 37%. The average age of participants was around 40 years, with mean ages around 37 and 43 for females and males, respectively. Participants distributed according to age and categorized into groups of 10 periods. The highest percentage of participants was in the third age group (31-40 years) representing around (27.9 %), while the lowest rate of participants was in the first and last age groups (older than 70 and in the range of 16-20 years). 89.1 % of participants were married. Moreover, the participants were divided into 4 groups according to their level of education. The highest percentage of individuals were university-educated, and the lowest percentage group was institute-level education. (table 1).

Table 1: Demographic Characteristics of the Study Population

Variables	Category	N	%
Gender	Male	370	37.0
	Female	630	63.0
Age	16-20	26	2.6
	21-30	245	24.5
	31-40	279	27.9
	41-50	245	24.5
	51-60	145	14.5
	61-70	54	5.4
	71-76	6	0.6
Marital status	Married	891	89.1
	Unmarried	109	10.9
Education	University	181	18.1
	males		
	females	320	32
	Institute	72	7.3
	Males		
	Female	73	7.3
	School	64	6.4
	Male		
	Female	136	13.6
	Uneducated	53	5.3
	Male		
	Female	101	10.1

On the other hand, only 24 individuals had acquaintances diagnosed with AL, please see (table 2). No one was personally diagnosed with AL.

Table (2) Diagnosed personally or knows someone diagnosed.

Diagnosis	N	%
Yes	24	2.4
No	976	97.6
Total	1000	100.0

Source of knowledge: 270 individuals had no previous knowledge about the disease, whether in terms of risk factors, clinical features, or treatment, but they occasionally were capable of giving their own opinions, after the survey-related conversation. 10% have acquired their knowledge from the local community and the internet. Formal education played a role in the knowledge of 47.9% of participants (table 3).

Table (3) Source of knowledge about leukemia

Source of knowledge	N	%
Social	151	15.1
Social, Official education	243	24.3
Social, official education, internet	236	23.6
Social, internet	100	10.0
No knowledge	270	27.0
Total	1000	100.0

AL risk factors: Only 28% of participants had no previous knowledge regarding AL risk factors. 67.6% of participants believed environmental causes, namely pollution, exposure to ionizing radiation, and exposure to chemicals like oil and its derivatives, played a significant role in causing AL; besides, genetic factors and viral causes were collectively mentioned by 34.9% of this study population; (figure 1). Environmental factors were mentioned by 68% of the study population and represented the main risk factor, followed by genetic factors, and weak immunity with percentages of 34.9% and 17.4% respectively.

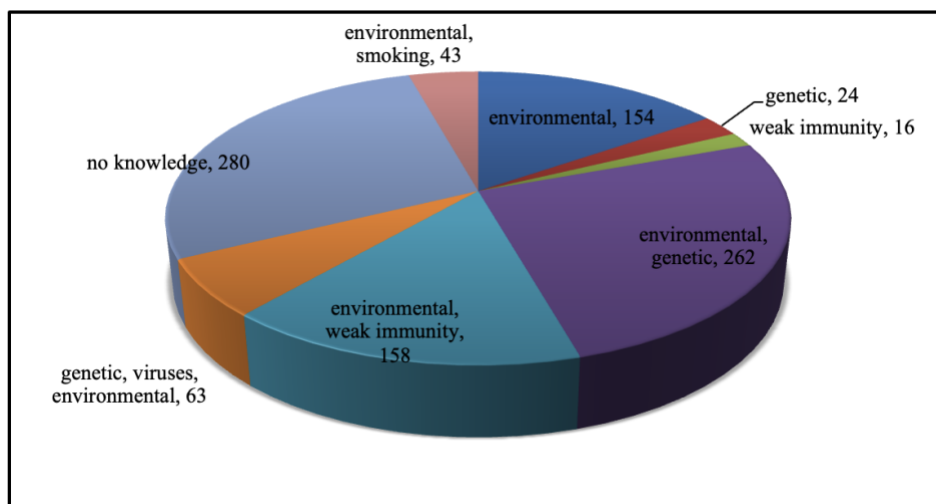


Figure 1: Acute leukemia risk factors mentioned by the study population.

17.7% of female individuals and 10.3% of male individuals had no previous knowledge of AL risk factors. Environmental and genetic factors were mentioned by most females and males (table 4)

Table 4: AL Risk Factors Knowledge Explained by Gender.

Risk Factors	Male	%	Female	%
Environmental	56	15.14	98	15.56
Genetic	9	2.43	15	2.38
Weak immunity	8	2.16	8	1.27
Environmental, genetic	95	25.68	167	26.51
Environmental, weak immunity	61	16.49	97	15.40
Genetic, viruses, environmental	25	6.76	38	6.03
No knowledge	103	27.84	177	28.10
Environmental, smoking	13	3.51	30	4.76
Total	370	100.00	630	100.00

AL clinical features: Questions on clinical features were left for the individuals to make their own guesses. 26.5 % of participants lacked previous knowledge of the clinical features of AL. Amongst the variable clinical features of AL, bleeding, pallor, and weight loss were mentioned by 49.1%, 34%, and 20.6% of this study's 1000-individual population, respectively; other symptoms are mentioned in (table 5).

Table 5: Acute Leukemia Clinical Features

Clinical Feature	N	%
Bleeding	23	2.3
Weight loss	36	3.6
Body pain, bleeding	56	5.6
Weight loss, fatigue	60	6.0
Bleeding, infections	56	5.6
Pallor, fatigue	17	1.7
Bleeding, pallor	112	11.2
Bleeding, weak immunity	55	5.5
Bleeding, pallor, fatigue	111	11.1
Bleeding, pallor, fatigue, weight loss	78	7.8
Pallor, fatigue, weight loss	22	2.2
Weight loss, weakness	64	6.4
Body aches, weak immunity	45	4.5
No idea	265	26.5
Total	1000	100.0

AL prognosis and prognostic factors: 50.9% of participants believed AL has a poor prognosis and the remaining percentage thought it would depend on the good prognostic factors and the patient's luck, (figure 2 a & b).

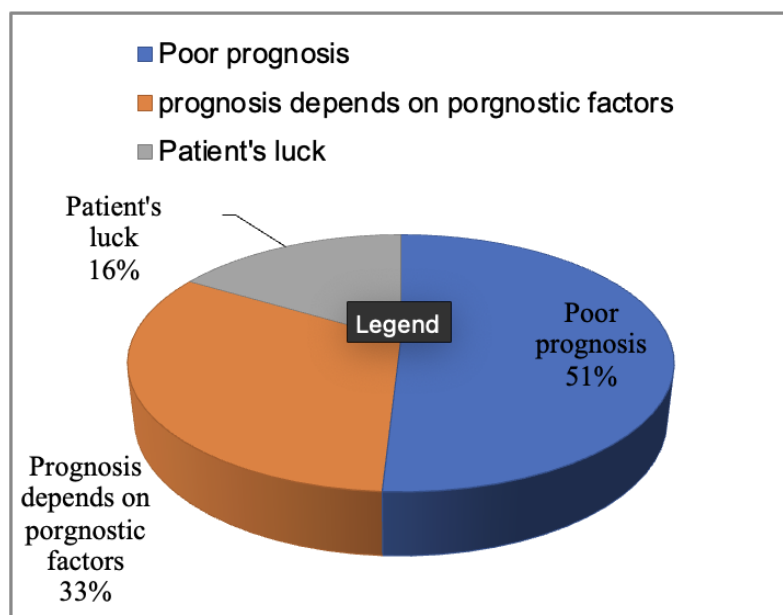


Figure 2 a: AL prognosis

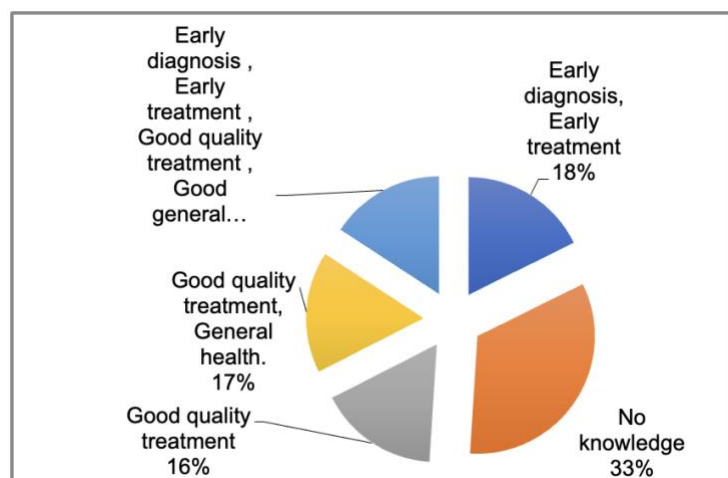


Figure 2 b: Right: Good prognostic factors, as per the study population.

Role of treatment and its complications: 71.6% of participants believed treatment, namely chemotherapy, played a significant role in AL treatment, improving patients' outcomes. The remaining chose the dismal outcome of acute leukemia patients in all conditions. 38.2% of all participants had no previous knowledge of treatment complications.

On the other hand, hair loss represented the commonest side effect mentioned by 61.8% of participants, followed by vomiting mentioned by 508 individuals (table 8).

Table 6: Role of Treatment and Treatment Complications

Side effect	N	%
Hair loss, vomiting	156	15.6
Hair loss, vomiting, weak immunity	111	11.1
Hair loss, anorexia, vomiting	196	19.6
Hair loss, anorexia, vomiting, infections	95	9.5
Hair loss, vomiting, weakness	60	6.0
No idea	382	38.2
Total	1000	100.0

Role of other diseases in AL patients: 41.9% of participants believed that the presence of other diseases in AL patient, like H.T., D.M, has no impact on patient prognosis. 10.9 % believed the AL patient condition will be worse. (table 9).

Table 7: Impact of Hypertension, Diabetes Mellitus and Autoimmune diseases on Acute Leukemia Patient

Category	N	%
Worse	109	10.9
Not related	419	41.9
No idea	469	46.9
Total	1000	100.0

Prevention of AL: 282 individuals had no previous knowledge of the prevention of AL. 43 individuals believed there were no practical preventive measures. Good general health as a preventive measure, explained by a good diet, avoiding canned food, eating vegetables and fruit, taking vitamins, and avoiding lack of sleep, being active like walking and movement, was mentioned by 496 individuals. 382 individuals, (table 10) cited stress reduction on the other hand.

Table 8: Acute Leukemia Preventing Factors

Factors	N	%
Good general health, reduce stress	203	20.3
Good general health	112	11.2
Reducing stress	33	3.3
Reducing stress, reducing pollution	146	14.6
Good general health, reduce pollution	181	18.1
No prevention	43	4.3
No idea	282	28.2
Total	1000	100.0

Knowledge of metastasis: 90% of the study population reported no knowledge of AL metastasis. 10% of them mentioned the spleen as a site of metastasis, followed by the brain.

DISCUSSION

AL represents one of the major malignancies in Iraq along with breast cancer, lung and bronchus, colorectal, and CNS malignancies, according to the annual Iraqi Cancer Registry 2022. In this study, public awareness of AL was assessed by surveying various demographics on their knowledge of AL's risk factors, clinical features, prognosis, treatment, and prevention. Our findings revealed the presence of gaps in understanding across different populations, which underscores the need for targeted educational interventions.

In this survey, the major participants were females with an average age of 36.7 years. The study population was divided into seven major groups according to age, with the highest percentage of individuals within the 31-40-year-old group, and most participants were married. The highest percentage of participants were educated with university degrees (Table 1). Females were better educated than males (table 1), but this higher percentage can be attributed to the higher number of female participants in the first place.

24 individuals had an acquaintance (a friend or relative) diagnosed with AL (Table 2). The survey revealed that 27% of participants had no previous general knowledge of AL. Those who have been already exposed to some general information had the local community (explained by people at work, friends, neighbors, and family members) as their major source of knowledge (Table 3). This indicates that more focus needs to be made on educating people through other sources like internet platforms and formal education to offer widespread access to information with accuracy and reliability; a similar suggestion was concluded in a study related to lung cancer screening by Strong and Renaud (Strong & Renaud, 2020).

The study also revealed that environmental factors, in terms of pollution, exposure to benzene and other oil derivatives, or fertilizers and pesticides, were considered the major risk factors for AL by the study population (Figure 1), and this goes with the evidence-based literature of the role of these factors in causing AL as stated by Poynter et al. (Poynter et al., 2017); however, the unclarity in describing the real significance of these factors and lack of knowledge regarding the effect of electromagnetic fields, hair dye, organic solvents, and viral infections, and maternal hair perming, drinking and smoking during pregnancy in causing AL indicates that these need to more dedication towards this aspect (Guo et al., 2022). For both females and males, environmental and genetic factors play a major role in causing AL (Table 4).

On the other hand, 26.5% of participants lacked knowledge regarding AL symptoms while bleeding, pallor, and weight loss were the main clinical features mentioned by the participants (table 5) this is partly well correlated to the AL clinical features stated by the national cancer institute (Ifeanyi, 2020). however, it still indicates that education needs to be targeted to understanding the wide range of AL symptoms and its role in early diagnosis and better treatment. A study conducted in Saudi Arabia by Naushed Abid et al has also demonstrated that bleeding and bruising were the most frequently mentioned symptoms to be followed by vomiting, nausea, headache, and swollen lymph nodes (Abid et al. 2023). Shahab and Raziq mentioned that fever, pallor, and bleeding were the main presenting features of AML, while enlarged liver, spleen, and lymph nodes were more commonly seen in ALL (Shahab & Raziq, 2014). Our findings showed a limited understanding of the factors influencing AL prognosis (Figure 2), with many participants believing in the old concept of poor prognosis, unaware of the significance of early diagnosis and specific genetic markers, and the importance of treating any emergent infections during treatment (Chang et al., 1976). This knowledge gap can lead to delays in seeking medical attention and a potential decrease in survival rates. Education campaigns should emphasize the importance of early detection and the role of genetics in prognosis to improve public understanding.

71.6% of participants believed treatment, namely chemotherapy, played a significant role in AL outcome. 38.2% had no previous knowledge of treatment complications, while hair loss was mentioned by 61.8% of participants and represented the commonest side effect, followed by vomiting mentioned by 508 individuals. Moreover, 38.2% had no previous knowledge of treatment complications ((Table 6). In Naushed Abid et al.'s study, dizziness and anorexia were found as the most frequent side effects of leukemia treatment mentioned by participants (Abid et al., 2023). This suggests an acceptable general knowledge; however, more focus needs to be directed to demonstrating the potential complications of AL treatment especially immunocompromise and risk of infections.

On the other hand, 10.9 % of participants believed that chronic illnesses have a negative impact on the course of the disease (Table 7). Hypertension and Diabetes have been specifically questioned as they are the major chronic diseases among the local population (Hussain & Lafta, 2019). DM has not been shown to play any poor prognosticator effect (Wiedmeier et al., 2021) and HT has been noticed to only represent a common acute and late complication of pediatric leukemia treatment (Murphy et al., 2022). Knowledge of AL prevention was assessed. Awareness of preventive measures was missing, focusing more on stress reduction and good general health in terms of a good diet (Table 8); this reflects a significant gap in public health education regarding lifestyle changes, and avoiding risk factors, as stated by Ilhan et al. in 2006 (Ilhan et al., 2006). Moreover, greater attention to the importance of screening programs that could potentially reduce AL risk is warranted. Leukemias, although not traditionally considered a fast-growing and spreading (metastatic) disease, is indeed highly efficient in causing metastasis (Whiteley et al., 2021). Only 27% of participants believed AL could metastasize to other organs, pointing to a need for better education on the pathophysiology of hematologic malignancies.

CONCLUSION

This study highlights significant gaps in public awareness of acute leukemia, particularly regarding risk factors, prognosis, and treatment options. Addressing these gaps through targeted education and reliable information dissemination is crucial for early detection and improved outcomes. By enhancing public understanding, we can foster a more informed community better equipped to support individuals affected by this disease. This study is not without limitations. The survey was limited to a specific geographic region, and the sample may not be representative of the general population. Additionally, the self-reported nature of the survey may introduce bias. The exclusion of participants younger than 16 years of age might overlook valuable insights into awareness and knowledge among those populations, as leukemia can affect individuals of any age group. Participants might respond in socially acceptable ways or could misunderstand certain questions. Besides, although the study gathers some basic social information, it does not explore participants' socioeconomic background, which might affect understanding of the variations in leukemia awareness across different social and economic groups. It is recommended that future research should consider a larger, more diverse sample and include qualitative methods to explore the underlying reasons for knowledge gaps.

Conflicts of Interest

The authors declare no conflicts of interest.

REFERENCES

- Abid, N., Bohamad, A. H., Aljohar, H. I., Al Battat, B. S., Altaher, Y. Y., Alateeq, A. E., ... & Al Jizan, A. (2023). Knowledge and Awareness of Leukemia Among the Population of Eastern Province, Saudi Arabia. *Cureus*, 15(10).
- Barrington-Trimis, J. L., Cockburn, M., Metayer, C., Gauderman, W. J., Wiemels, J., & McKean-Cowdin, R. (2017). Trends in childhood leukemia incidence over two decades from 1992 to 2013. *International journal of cancer*, 140(5), 1000-1008.
- Chang, H. Y., Rodriguez, V., Narboni, G., Bodey, G. P., Luna, M. A., & Freireich, E. J. (1976). Causes of death in adults with acute leukemia. *Medicine*, 55(3), 259-268.
- Döhner, H., Estey, E. H., Amadori, S., Appelbaum, F. R., Büchner, T., Burnett, A. K., ... & Bloomfield, C. D. (2010). Diagnosis and management of acute myeloid leukemia in adults: recommendations from an international expert panel, on behalf of the European LeukemiaNet. *Blood, The Journal of the American Society of Hematology*, 115(3), 453-474.
- Gómez-De León, A., Demichelis-Gómez, R., da Costa-Neto, A., Gómez-Almaguer, D., & Rego, E. M. (2023). Acute myeloid leukemia: challenges for diagnosis and treatment in Latin America. *Hematology*, 28(1), 2158015.
- Guo, Y., Wang, W., & Sun, H. (2022). A systematic review and meta-analysis on the risk factors of acute myeloid leukemia. *Translational Cancer Research*, 11(4), 796.
- Hailu A, Mekasha A, Hailu D, Fentie AM, Korones DN, Gidey AM. Impact of delay prior to treatment in Ethiopian children with acute lymphoblastic leukemia. *Pediatric Health, Medicine and Therapeutics*. 2023 Dec 31;147-57.
- Hussain, A. M., & Lafta, R. K. (2019). Burden of non-communicable diseases in Iraq after the 2003 war. *Saudi medical journal*, 40(1), 72.
- Ibrahim, R. M., Idrees, N. H., & Younis, N. M. (2023). Epidemiology of leukemia among children in Nineveh Province, Iraq. *Rawal Medical Journal*, 48(1), 137.
- Ifeanyi, O. E. (2020). Acute Leukaemia: A Sudden Killer to Human Beings. *EC Emergency Medicine and Critical Care*, 4(6), 154-67.
- Paul, S., Kantarjian, H., & Jabbour, E. J. (2016, November). Adult acute lymphoblastic leukemia. In *Mayo Clinic Proceedings* (Vol. 91, No. 11, pp. 1645-1666). Elsevier.
- Ilhan, G., Karakus, S., & Andic, N. (2006). Risk factors and primary prevention of acute leukemia. *Asian Pacific Journal of Cancer Prevention*, 7(4), 515.
- Inaba, H., & Pui, C. H. (2021). Advances in the diagnosis and treatment of pediatric acute lymphoblastic leukemia. *Journal of clinical medicine*, 10(9), 1926.
- Karim, Z. A., Khidhir, K. G., Ahmed, R. A., Hassan, H. A., & Karim, D. O. (2016). Leukemia study in sulaymaniyah province, Kurdistan, Iraq. *Chinese medical journal*, 129(02), 244-245.
- Mjali, A., Al-Shammari, H. H. J., Abbas, N. T., Azeez, Z. D., & Abbas, S. K. (2019). Leukemia epidemiology in Karbala province of Iraq. *Asian Pacific Journal of Cancer Care*, 4(4), 135-139.
- Murphy, L., Maloney, K., Gore, L., & Blanchette, E. (2022). Hypertension in pediatric acute lymphoblastic leukemia patients: prevalence, impact, and management strategies. *Integrated Blood Pressure Control*, 1-10.
- Poynter, J. N., Richardson, M., Roesler, M., Blair, C. K., Hirsch, B., Nguyen, P., ... & Warlick, E. (2017). Chemical exposures and risk of acute myeloid leukemia and myelodysplastic syndromes in a population-based study. *International journal of cancer*, 140(1), 23-33.
- Shahab, F., & Raziq, F. (2014). Clinical presentations of acute leukemia. *J Coll Physicians Surg Pak*, 24(7), 472-6.
- Strong, A., & Renaud, M. (2020). Using social media as a platform for increasing knowledge of lung cancer screening in high-risk patients. *Journal of the Advanced Practitioner in Oncology*, 11(5), 453.
- Tebbi, C. K. (2021). Etiology of acute leukemia: A review. *Cancers*, 13(9), 2256.
- Whiteley, A. E., Price, T. T., Cantelli, G., & Sipkins, D. A. (2021). Leukaemia: a model metastatic disease. *Nature Reviews Cancer*, 21(7), 461-475.
- Wiedmeier, J. E., Mountjoy, L. J., Buras, M. R., Kosiorek, H. E., Coppola, K. E., Verona, P. M., ... & Karlin, N. J. (2021). Mortality and glycemic control among patients with acute and chronic myeloid leukemia and diabetes: a case-control study. *Future Science OA*, 7(1), FSO639.
- <https://moh.gov.iq/upload/2991322580.pdf>