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Incidence of Acute Childhood Leukaemia in Gezira State - Sudan. Population-Based Study

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Abstract: Background: Leukaemia *is the greatest mutual basis of pediatrics malignancy. It constituted 31% of entire cases and dispersed annually at a rate of 43cases /millions of children who are being below 15 years.* ***Objective:*** *To determine the incidence rate of childhood acute leukaemia in Gezira state, Sudan.* ***Subjects and Methods:*** *A retrospective population-based study was conducted during (2005-2014) in central Sudan (Gezira state). All participants were aging (0-15 years) and diagnosed with acute leukaemia. Data was gotten from the database of the statistical subdivision element at the national cancer institute, University of the Gezira, Sudan. The statistical analyses were performed by using SPSS packages besides applying some descriptive statistical measures.* ***Results:*** *The study, bared that 137 children were diagnosed with acute leukaemias in Gezira state with an incidence rate of 9.4/million during the study period. The males were instituted 76(55.5%) and females 61(44.5%) with a ratio of around 1.25 for all diverse leukaemias types. A percent of 58(42%) was registered for Myeloblastic leukemia (AML) with an incidence rate of 3.94/million and 79(58%) for Acute lymphoblastic leukemia (ALL) with a rate of 5.70/million correspondingly. Almost 56(74%) of the males harbor ALL and 20 (26%) AML types. While females initiate 23(38%) ALL and recruit 38(62%) AML. The incidence rate of ALL was found to be 6.66/ million in males and 4.76/million in females. Whereas, the incidence rate of AML was 2.4/million for males and 5.48/million in females respectively.* ***Conclusion and Recommendations:*** *The existing study exposed that, acute childhood leukaemias is the most prevalent type of childhood cancer in Gezira state. Whereas, the ALL type is the most recurrent type of childhood leukemia in Gezira state. The study originating that males are found to be the most affected patients by acute leukemia than females. The communal age of presentation is differed rendering to the types of leukemia and the gender as well. Further studies should be recommended to map the ALL, AML and CML target pouches to better understanding the causes of the extraordinary invasion rate of the cancer type among children in the state and the neighboring districts. Additional studies should be focused on the germline predisposition for restoring fast recognition as an essential peril factor causal to the growth of childhood ALL. Furthermore, the contest has currently lain in what way ultimate to capitalize on germline of genetic evidences for developing ALL treatment approaches, diagnosis, and possibly flush restriction as well. Finally, effective collaborations between environmental geochemists and cancer epidemiologists are critically needed.*

Keywords*:* Acute lymphoblastic leukaemia (ALL), Myeloblastic leukemia (AML), chronic myeloid leukemia (CML)**,** Age-standardized incidence rates (ASR), central nervous system (CNS), Gezira and Sudan

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Introduction:

Leukaemia is the extreme collective basis of childhood malignancy at age under 15years. It has remained disseminated annually at a rate of 43cases /millions of children who are being below 15 years. It represents 31% out of total cases ascending among children who are annually diagnosed and being below 15 years. In Sudan and other neighboring countries, this ailment has been increasing at a frightening rate, causing mortality and generating an inverse impact of socioeconomic standing. However, in the USA; 79% of total cases are institute to be (ALL), followed by (AML), chronic myeloid leukemia (CML) and other types. [1-3].These outcomes shared the same consistency in white skinofthe European, the Americans and Oceania populations and similarly in eastern Asia. In history, the standard of childhood cancers, together with (ALL), was not supposed to partake in a genetic root. Though, current investigations regarding the germline genomics have discovered that about 5 – 10% of children bear tumor and around 3 – 4% victims harbor ALL) and the later, progress the illness due to a core of heredity vulnerability. [4] Previous studies have publicized that, around 33,3% of all childhood tumors are established to be leukaemias, with ASRs of 35-50per million. Acute lymphoblastic leukemia (ALL) comprises75-80% of the total disease incidences, with ASRs ranging 25-40 per million. The obvious peak of incidence rate regarding (ALL) type was attained at age ranging (2-3years). However, in dark skin children leukemia accounts for about 25% of all types in the USA. The incidence rate of all cancer types accounts for around half the number that registered for whites. This consequence is predominantly referred to as the discernible reduction that ensues in the peak of disease incidences at an early age. However, in the UK, the incidence rate of the disease is fairly less in original West Indian than that generated in British whiteskinchildren. [5, 6]

In Northern Africa countries, although data is somewhat fairly scant. It seems that the occurrence of leukemia is not as far-off lower as it arises in European countries. Recent studies in the continent have verified, similar distribution accomplished with arising in the peak of ALL incidence rates in young children. In Egypt, a case of a series study was implemented in the National Cancer Institute Centre in Cairo (NCICC). The study has quantified 107 /123 (87%) as ALL types of childhood leukaemias with a modest peaking rate at (3-6 years) of age class. Conversely, in sub-Saharan Africa, the incidence of leukaemia and the occurrence of ALL types are found to be exclusively lower than those reported for white skin nations. No, significant results were registered for age in study subjects. The reduction occurs in the incidence rate is partly denoting to the consequences of under-reporting and diagnosing.[7-9] Nonetheless, cancer registries in Africa suffered from a lack of good medical supply and incompetent methods for detection such as diagnosing by blood smearsor by applyingcytology procedures. Moreover, in practice of pediatric knacks in the tropics, diagnosis of leukaemias might have been unexploited since the common clinical presentation of childhood lymphadenopathy, leukemia-fever and anemia-is easier to get confusing with extra reciprocal circumstances. Therefore, the diagnostic methodscould be squandered on the check of blood smears, wherever, blast cells capacitymight be misguided for the stimulation of common lymphocytes that are invaded in amalaria- infected child. In conclusion, children (particularly the young ones) by the above-mentioned indications should be subjected to medical care before the rapid evolution of the disease-causing death. [9, 10] In Sudan acute ALL accounts for (19.8%) and AML (4.2%) among all childhood malignancies. [11]

Subjects and Methodology: Gezira is one of the largest states in Sudan. The population of Gezira state was estimated by 3,575,280 with approximate quotient around (49.3:50.7) for a male to female ratio. The children constitute about 1,448,921 (40.5%) out of the total population, according to the latest population census held in 2008. It has 150, 36 and13 healthcenters, rural hospitals,andsecondary hospitals correspondingly. Gezira state was measured as the richest state in the country before the detection and extraction of petroleum. The National cancer institute (NCI) which was founded in the early nineties is now renamed of what so-called in the past Institute of Nuclear Medicine (INMO). This center is the second oncology center in Sudan. New circuits and subdivisions are designed and established in a modern multidisciplinary approach. In (NCI) for, care, caters and to cope with cancer patients in Gezira state and the surrounding districts. A retrospective population-based study (a study using hospital records) was conducted during (2005-2014) in central Sudan (Gezira state). A total of 137 children were diagnosed with acute leukaemias in Gezira state, central Sudan. All patients were aging (0-15 years) and diagnosed with acute leukaemia.41patients were (0-4 years), 48 (5-9 years) and 48 (10-14 years). The distribution of age for males from (0-4 years) was 24 (31%), 28 (38%) for (5-9 years) and24 (31%) for (10-14 years) consecutively. Mass population data was dug out from a datase of the statistical portion unit at the national cancer institute, University of the Gezira, Sudan. The statistical analysis was completed by using SPSS packages in addition to applying several descriptive statistical measures.

Results: Leukaemia forms one of the main sources of death in children. It is identified as the most collective cause of childhood malignancy under the age of 15years. The present study revealed that a total of 137 children were diagnosed with acute leukaemias in Gezira state during the study period (2005- 2014) with an incidence rate of 9.4/million. The current study exposed that the males were instituted 76(55.5%) and females 61(44.5%) with a ratio of about 1.25 for all patients who diagnosed with diverse leukaemias types (Fig. 1: A). In this study, a percentage of 58(42%) was enumerated for Myeloblastic leukemia (AML) and 79(58%) for Acute lymphoblastic leukemia patients (ALL) with an incidence rate of 3.94 and 5.70/million respectively. (Fig. 1: B).A percentage of 56(74%) of the males harbor ALL and 20 (26%) AML types. While females initiate 23(38%) ALL and 38(62%) AML (Fig. 2: A). The incidence rate of ALL was found to be 6.66/ million in males and 4.76/million in females. While the incidence rate of AML was 2.4/million for males and 5.48/million in females. The study also disclosed that the incidence rates for patients participated in the study were 41(30%), 48 (35%) and 48(35%) with age extending from (0-4 years), (5-9 years) and (10-14 years) serially (Fig. 2: B). The scattering incidence rates in males were originating 24 (31%), 28 (38%) and 24 (31%) for age classes prolonging from (0-4 years), (5-9 years) and (10-14 years) successively. Whereas, for females recorded 17 (28%), 20 (33%) and 24 (39%) for the age classes fluctuating from (0-4 years), (5-9 years) and (10-14 years) sequentially (Fig. 2: C).

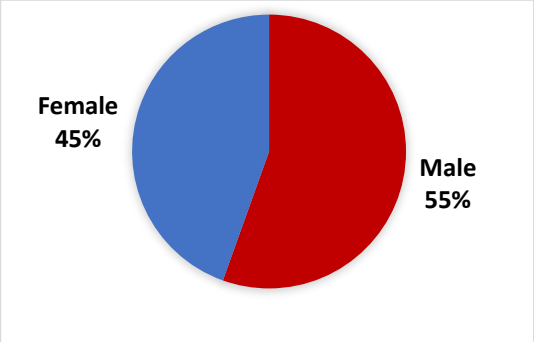

Fig. 1: A. Shows the percentages of males and females diagnosed with acute leukaemias in Gezira state during the study period (2005- 2014)

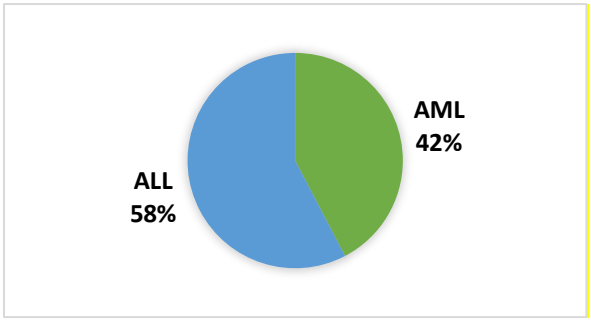

Fig. 1: B. Illustrates the percentage registered for Myeloblastic leukemia (AML) and 79(58%) for Acute lymphoblastic leukemia patients (ALL) in Gezira state during the study period (2005- 2014)

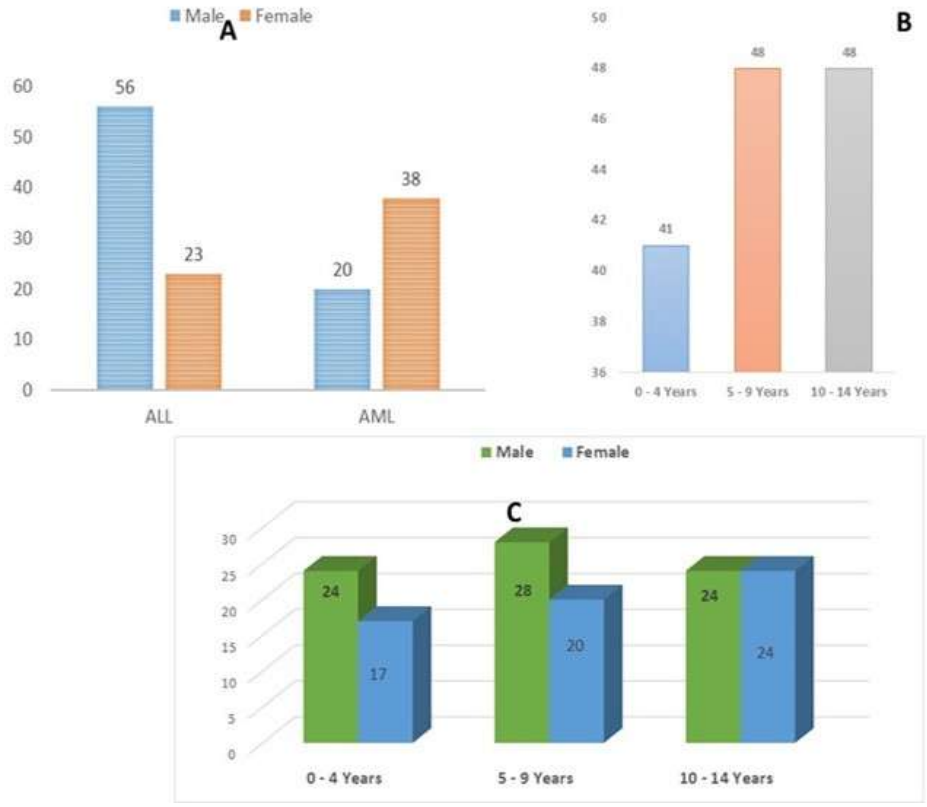

Fig. 2: A.The distribution of incidence rates for males harbor ALL and AML types. **B:**The scattering of incidence rates in males for age classes extending from (0-4 years), (5-9 years) and (10-14 years) successively. **C:**The dissemination of incidence rates in females for age classes prolonging from (0-4 years), (5-9 years) and (10-14 years) respectively.

The common diagnostic age for ALL is 5-9 years in males with an age-specific rate (ASR) of 7.68/million, and 10-14 years with ASR of 5.7/million for females (Fig. 3:A).The common age of AML is (5-9 years) with ASR of about .56/million in males. Whereas, the pooled age of AML diagnosis is ranging from (10-14 years) in a female with ASR of 9.98/million (Fig.2: B).In the present study (Fig. 3: A, B, and C) illustrate the comparison apprehended for ALL with ASR in Gezira state and among selected countries. In contrast, the current study verified the differences between ASR for ALL in Gezira state and selected countries. The incidence rate of AML in Gezira state was 3.94 /million children aged between (0-14 years), while the incidence of ALL accounts for 5.7/million. The incidence rate in males was 2.40/million for AML and 6.66 /million for ALL. Though the incidence in females was 5.48/million for AML and 4.76/million for ALL (Fig. 2: C and Fig. 3: A).

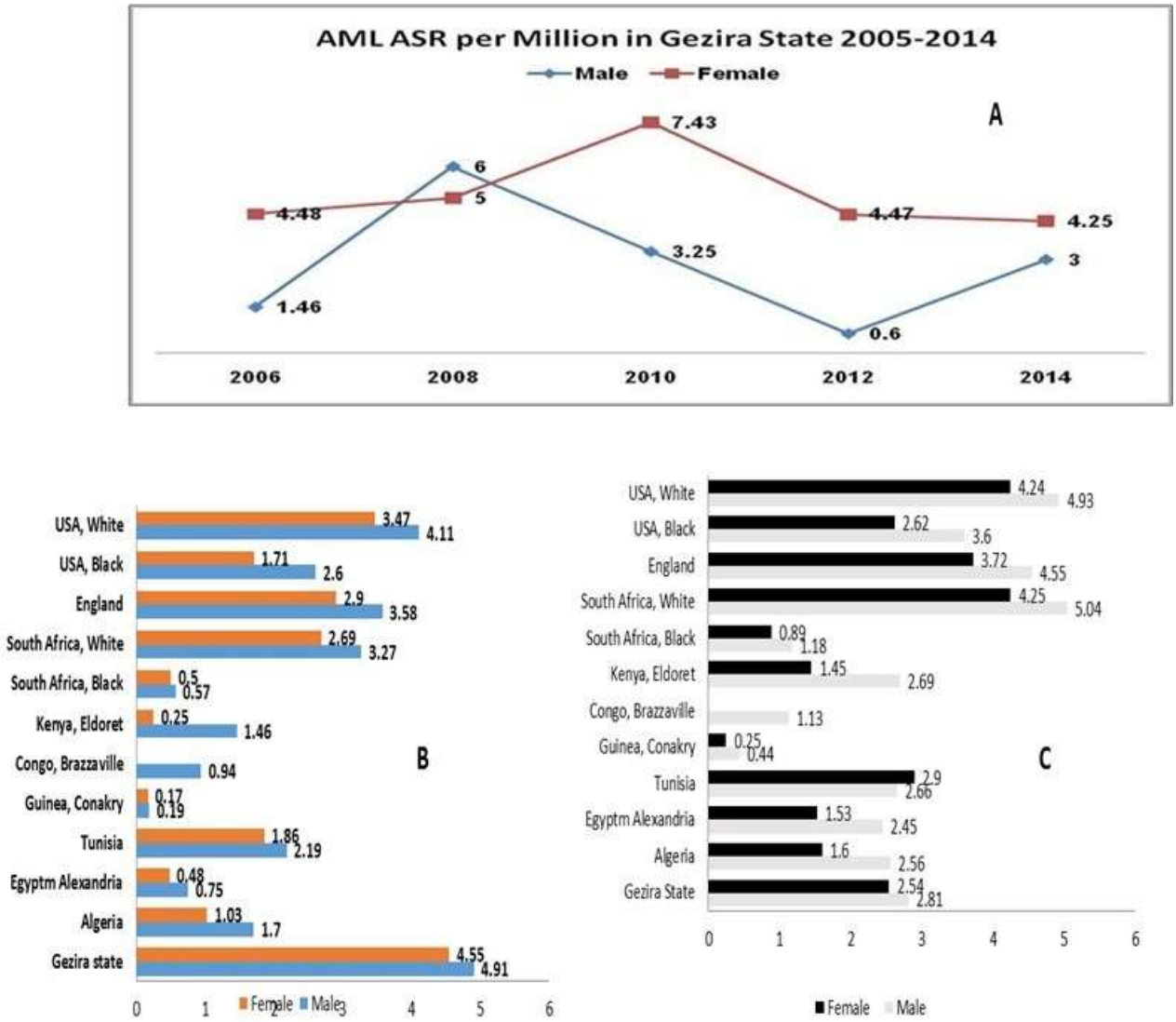

Fig. 3: A. validates AML withASR per million among males and females in Gezira state during the study period (2005-2014):**B.**illustrates thecomparison apprehended for ALL with ASR among Gezira state and selected countries**: C.**demonstrates thecomparison held for ALL with ASR among Gezira state and selected countries.

Discussion: Leukemia is the highest mutual form of cancer in childhood. Many factors such as acquaintance to definite viruses, conservational factors, various infections, and chemical disclosures have been concomitant with destruction to the immune system. Regardless, the specific genomic patterns, diminutive information is known about the reasons for childhood causing leukemia. In general, the mainstream of childhood leukaemias is integrated genetic diseases. This means that chromosome abnormalities and gene mutations in cells occur periodically. [4, 12-16] Nevertheless, the immune system plays a significant role in defending the body from diseases, and possibly cancer. An amendment or inadequacy in the immune system may increase the risk of emerging leukemia. It worth mentioning that childhood Leukemia's types differ prominently from adult tumors in their nature, prognosis and,distribution.[16] The configurations of childhood tumors in Europe and the USA are practically indistinguishable, with (CNS) tumors and leukemia rating for above50% of the hot cases. In discrepancy, lymphoma is being the supreme communal predominant childhoodtumorat the ageof 15 years in African countries. [17, 18]

In the present study, the prevalence rate of acute childhood leukemia is found to be around 9.4/million during the study period. Previous studies in the USA have shown lower accounts of incidence rate for about 43/million in childhood [1-3] However, the higher prevalence rate is registered in Malawi 1.1 and 4.0 / million Mali respectively. [19] Whereas, the incidence rates are initiated 8.6 for Nigeria and 10.3/ million for Uganda respectively. [19] The study also demonstrated that the incidence rate is quite differed according to socioeconomic status. In low-income countries, the incidence rate established 16.4/million and 36.5/million in middle-income countries consecutively. [19] The standing study also verified that females are not more predominating to the infirmity than the males with an incidence ratio of 1.2. These outcomes shared the same consistency with the other studies in Zimbabwe and KSA. [20, 21] The current study publicized that 70% of cases were exposed to be affiliated or

conglomerated with acute childhood leukaemias with the commonest age at presentation of more than 5 years. These outcomes share the same conformity with a study completed in the USA. Comparative studies in the states have abstracted that the common age in males is less than 5 years. [2] Whereas, in divergence, this study disclosed that the common age in males ranges from (5-9 years) and above 10 years for females.[2] This study has ended that ALL accounts for 58% of the overall acute childhood leukemia in Gezira state with an incidence rate of 5.7/million. These results are inconsistent with the preceding study in Egypt that scored higher percentages of ALL accounts than those registered in Gezira. [22, 23] However, these consequences are being more than those estimated around 25% and documented in KSA of the inclusive childhood cancer.[24] ALL affecting males more than the females with an incidence rate of 6.66/million compared to 4.76/million in females. These findings are quite similar to the results obtained in the USA studies. The consequences of the studies revealed that boys are more affected by ALL than females. [25, 26] The commonest age of presentation of ALL in males was (5-9 years) with an age-specific rate of 7.68/million and for females was 10-14years with an age-specific rate of 5.7/million. The predecessor outcome is found to be less than those recorded in South Africa and is more common in children aged 2-3 years with an incidence rate of 90/million per year. [27] AML accounts for 42% of acute childhood leukemia in Gezira state with an incidence of 3.94/million which is less than the international incidence of 7.6/million.[2]

AML was more common in females than in males with an incidence of 5.48/million compared to 2.4/million in males which is not similar when compared with the USA reading report. This finding shows no difference logged in the incidence rate of AML between males and females. [2, 26]The commonest age of diagnosis for AML in females was 10-14years with an age-specific rate of 9.98/million compared to 5.7/million in the USA while in males was 5- 9 years with an age-specific rate of 2.56/million compared to 5.9/million in the USA. [2, 26] In contrast recent data were collecting for probing the survival of pediatric tumors and theoccurrence rate inchildren aged(0 – 19) years. These consequences were identified and scanned conferring to ethnicity, geographic region age and,gender. The outcomes showan entire age-adjusted prevalence rate of 172.4 / million for children aged directly above 15 years and 153.4 / million for children aged(0 -14 years) amongst the 4255 cases of childhood tumors. The frequency rate for boys was higher than girls (192.5 and 153.3 successively). The results also demonstrated that the rate was found to be higher for Jewish children than those recorded for Arab children (177.6and 156.8, respectively). The prime patients were leukaemias (22%), followed by lymphomas (20.2%) and (CNS) tumors (17.4%).Although the incidence rate remained steady, the total of new cases augmented each year. The inclusive survival attained at 5 years and was 83.2% for the Jewish population and 72.8% with 80.8%, for the Arabic population depending on the diagnostic approaches. The study concluded that the incidence rate and survival in childhood tumors are identical and having a medium level when compared with other parts of the world. [26] Interestingly, the current study may set up the baseline datum and creates obvious avenues for studying the interaction between genetic makeup and environmental conditions that root for pediatric tumors in Sudan, describing the genetic basis for ethnic origin disparities and their roles in prevailing tumor incidence rates. In conclusion, the contemporaneous study revealed that acute childhood leukaemias are the most common types of childhood cancer in the Gezira state. Acute lymphoblastic leukemia is the most frequent type of childhood leukemia. Males are more affected by acute leukemiathan females. The common age of presentation is different according to the type of leukemia and the gender of patients. Further studies are recommended for enforcement and validations of the information packages all over the country, together with establishing the cancer registry in each state of Sudan. The creation of training flows and maintaining the international tides among cancer registries is censoriously recommended

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