

Childhood leukemia and power stations in Basrah governorate, an ecological study

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Abstract

The reports of leukemia among children in Basrah are of continuing interest, as is the possibility that electromagnetic field is one of the causative factors. The aim of this study is to assess the relationship between the distribution of power stations in Basrah and incidence of childhood leukemia. An ecological study designed to investigate the correlation between the distribution of power stations in Basrah and five years average incidence rate of leukemia among children aged below 15 years in Basrah. This study found ecological correlation between incidence rate of leukemia among children in Basrah and location of power stations in Basrah. It can be seen that, Al-Hartha (where higher level of exposure to EMFs) have higher incidence rates of childhood leukemia, the Spearman correlation coefficient between the location of power stations and incidence rate of childhood leukemia in Basrah, was high ($r = 1.0$) and statistically significant ($p = 0.01$). In conclusion the power to generate hypothesis about the relationship and causality of location of power stations and leukemia risk is high. There is still insufficient scientific knowledge, and new analytical studies are needed to clarify a possible leukemogenic effect of residential exposure to electromagnetic field.

Introduction

Childhood leukemia has remained a focal point of extensive etiologic, diagnostic, and therapeutic research since its recognition as a clinical entity over a century ago (Pinkel+Pui,1993). Multiple risk factors are thought to play a role in leukemia. These factors include environmental pollution, diet, viral infections, and familial and genetic factors (Adami *et al.*,2002).Generally accepted associations, however, explain only 10% of childhood leukemia incidence, leaving the majority with unexplained etiology(Ichimaru *et al.*,1978). Since1979 there has been concern that electric fields may be associated with cancer (Wertheimer+Leeper,1979).

Consistent epidemiologic evidence of an association between childhood leukemia and exposure to electromagnetic fields (EMFs) has led to their classification by the International Agency for Research on +Cancer as a

"possible human carcinogen (IARC ,2002).

There are reports of increased rates of cancers among the population of Basrah [Yacou *et al.* ,1999, Yacoub *et al.*,1999]. The percentage of rise in the incidence rates about 39.1% in case of leukaemia (Habib *et al.*,2007). The highest incidence rate of leukemia in Basrah was documented in Al – Hartha. This region is characterized by the presence of two out of the four power stations in Basrah (Al – Hartha power station and Al – Sheaba power station) with their power lines. Also, Al –Najebia power station is located in east border of Al – Hartha. This finding raises the question about the effect EMFs that emit from these power factories on the health of children who live in this area. The purpose of this study is to present the ecological correlation between the locations of power stations and the

incidence rates of childhood leukemia in Basrah.

Material and methods

The location of power stations was compared with the five years (2003 to 2007) average incidence of childhood leukemia. This type of comparison is referred to as an ecological study, which means that it can help to formulate a hypothesis about the link between exposure to EMFs and leukemia among children in Basrah. The location of power stations was dotted on the map of Basrah. According to this map the exposed population was clearly distinguished from the non – exposed population to avoid dilution of cancer rates. To reach to this goal, Basrah governorate was divided into seven geographical areas according to the system used by the health authorities in which Basrah governorate is divided into health sectors. These areas are: Basrah city center, Abu – Alkaseeb (including Al – Fao), Al – Zubair, Al – Qurna, Al – Mudaina,

Shatt – Alarab, and Al – Hartha. These seven areas were grouped according to the presence of power stations into 3 groups: exposed areas including: Al – Hartha region, less exposed area including Al – Zubair region, and not exposed area including others. Information related to population of Basrah was based on data available with Basrah health authorities, the electronic lists and statistical office in Basrah. Information about childhood leukemia are based on all cases of leukemia which were registered at pediatric oncology ward in childhood and maternity hospital in Basrah, which is the main site for registration and administration of cytotoxic chemotherapy in southern Iraq in period between 2003 to 2007. The incidence rate (IR) is classically expressed as the average number of cancer cases occurring per 100000 persons each year (Silman + Macfarlane ,2002). All data were analyzed using the SPSS, version 15 software. To assess the relationship between

childhood leukemia and level of exposure to DU, Spearman bivariate correlation coefficient analysis was performed. In this analysis, the statistical significant association was determined. All p values were based on 2-sided tests, and $p < 0.05$ was considered statistically significant.

Results

The overall incidence rate reported among children between January 2003 and December 2007 was 3.98 per 100000. This

represented 47.2 % of the total percentage of cancers among children in Basrah. The total reported incidents show that cancer was predominant in boys (55.3%) than in girls (44.7%), with a male to female ratio of 124:100. The percentage distribution of leukemia by age and sex was presented in Figure 1. More than half of cases (58%) are above 5 years of age. The highest percentage showed at age 5 to 14 years.

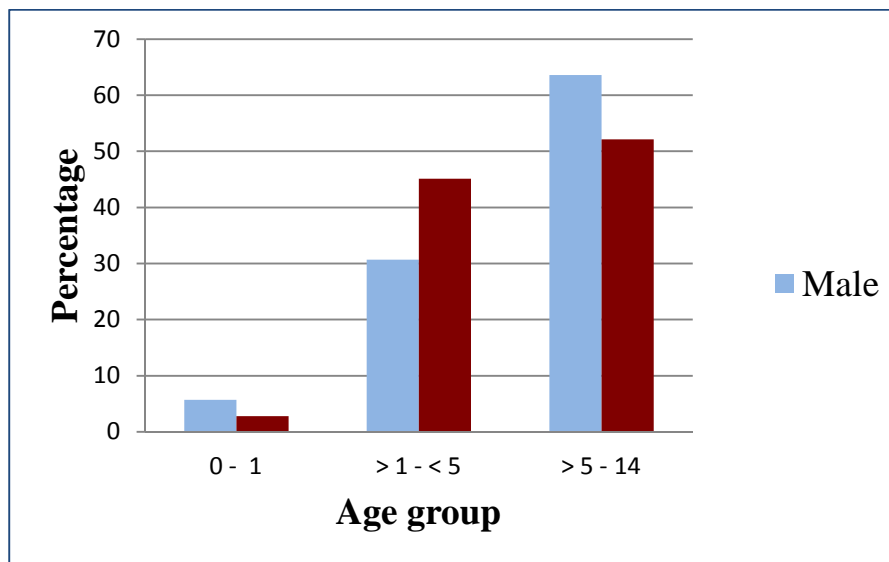


Figure 1. Percentage distribution of leukemia by age and sex among children below 15 years in Basrah, Iraq 2003 – 2007.

The incidence rate of leukemia from 2003 to 2007 were 4.25/100000, 3.58/100000, 4.88/100000, 2.64/100000, and 3.80/100000

respectively Figure 2. This finding shows no increase in incidence rate of childhood leukemia after 2003 in Basrah.

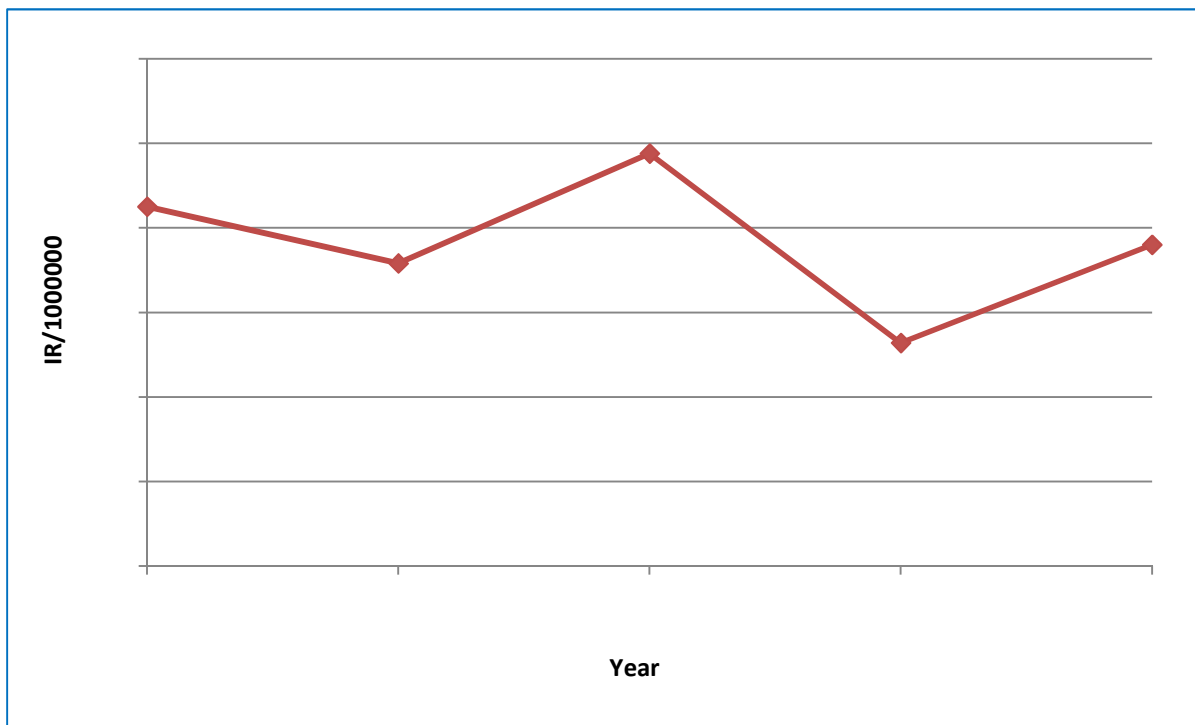


Figure 2. Pattern of Incidence rate of childhood leukemia per 100000 after Gulf war 2003.

Figure 3 shows the distribution of power stations in Basrah and the incidence rate of leukemia which clearly demonstrates the relationship between the location of power stations and the incidence rate of childhood leukemia.

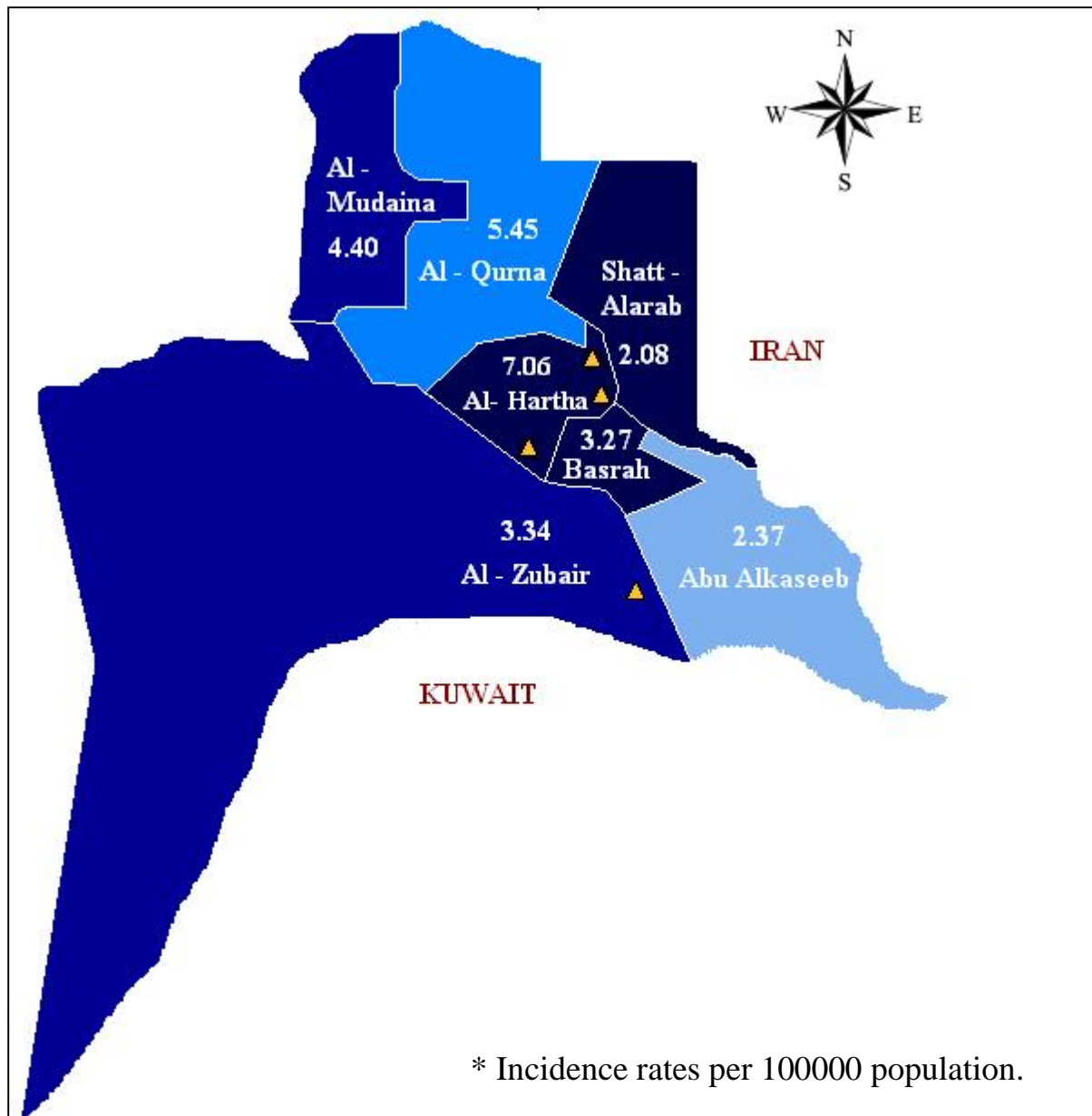


Figure 3. Distribution of power stations in Basrah and Incidence rate* of childhood leukemia by region in Basrah, 2006.

It can be seen that, Al-Hartha (where higher level of exposure to EMFs) have higher incidence rates of childhood leukemia. According to the Spearman correlation coefficient between the location of power stations

and incidence rate of childhood leukemia in Basrah, the correlation coefficient was high ($r = 1.0$) and statistically significant ($p = 0.01$) (Figure 3).

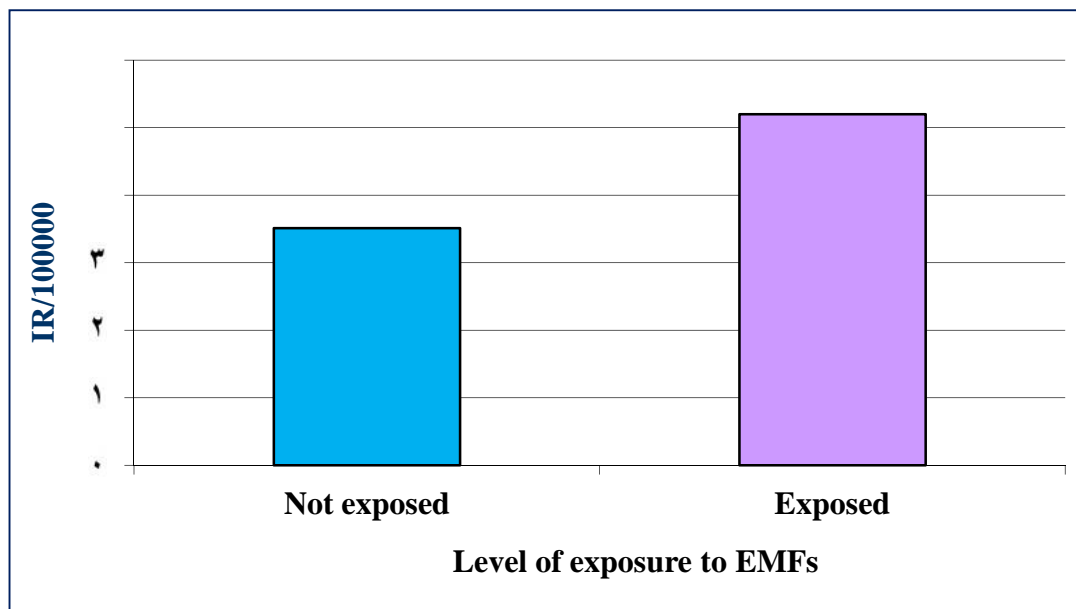


Figure 4. Spearman correlation between location of power stations and incidence rate of childhood leukemia ($r = 1.0$, $p = 0.01$).

Discussion

There have been considerable concern and controversy recently about the effects on health from the increasing exposure of populations to

extremely low-frequency EMFs (Merchant *et al.*,1994). The first report of an association between EMFs and cancer emerged from a study of child cancer deaths in which it was

concluded that children from homes exposed to high levels of EMFs had a two- to threefold greater risk of developing leukemias or lymphomas than children exposed to lower levels (Wertheimer + Leeper ,1979). Three recent reports were confined to children living near power lines and concluded that there was an increased risk of childhood leukemia at exposure levels of $>0.2 \mu\text{T}$ [Feychting+Ahlbom,1993, Olsen+Nielsen+Schulgen,1993, Verksalo *et al.* ,1993]. Contrary to above studies that reported childhood leukemia risk increasing with exposure to EMFs. The study carried out by national cancer institute revealed no association between a risk for acute lymphoblastic leukemia and EMFs strength within the homes of the children (Linnet *et al.*,1997).

To date this is the first ecological study of childhood leukemia and location of power stations in Basrah, We found that the correlation

coefficient was 1.0 for children whose home address was within area of power stations and lenses compared with those who lived away from these stations. It is clear that the results of the present study do not provide a clear answer to the question of whether EMFs exposure influences the development of leukemia. This is due in part to many factors: no specific known EMFs exposure parameter with which correlations should be made. The second problem is more difficult to address because it comprises many components like wiring configuration, measurement of distance from source, and direct measurement of fields. Also, Populations near power lines may have different characteristics from the rest of the population. Finally, the conclusion was ecologic in nature and did not control for confounding factors at the individual level, include socio-economic status, residential mobility, residence type, viral contacts, environmental tobacco

smoke, dietary agents, and traffic density (Poole *et al.*,2006).

Conclusion

In conclusion, The EMFs and leukemia association has been studied extensively and further studies of similar design are unlikely to provide new insights; only studies that can substantially improve exposure assessment and/or identify highly exposed persons or susceptible subgroups can be informative. The question of ecological fallacy should be further investigated, particularly the relationship between magnetic fields, socioeconomic status, mobility, and participation. Ultimately, ecological fallacy can only be resolved with large well-conducted cohort studies or with case-control studies in which exposure information can be collected independently.

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العلاقة ما بين مرض اللوكيميا بين الاطفال و محطات انتاج الطاقة الكهربائية في محافظة البصرة

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يحظى موضوع مرض اللوكيميا في محافظة البصرة باهمية كبيرة. حيث من الممكن ان تكون الموجات الالكترومغناطيسية الناتجة من محطات الطاقة الكهربائية احد المسببات لهذا المرض. تهدف الدراسة الى تحديد مدى العلاقة ما بين اماكن وجود وانتشار محطات انتاج الطاقة الكهربائية مرض اللوكيميا بين الاطفال. صممت هذه الدراسة البيئية لفحص العلاقة ما بين اماكن انتشار محطات انتاج الطاقة الكهربائية في البصرة و معدل حدوث مرض اللوكيميا لمدة خمس سنوات للاطفال بعمر اقل من . تم ايجاد علاقة ما بين معدل حدوث مرض اللوكيميا بين الاطفال في البصرة و مواقع انتشار محطات انتاج الطاقة الكهربائية. حيث يمكننا ملاحظة زيادة معدلات حدوث مرض اللوكيميا بين الاطفال في مدينة الهارثة (حيث توجد نسب عالية من التعرض للموجات الالكترومغناطيسية)، حيث كان معامل العلاقة الاحصائية عالي (قيمة مع =) و ذات دلالة احصائية عالية (قيمة $p =$). تعطينا القدرة على بناء نظرية حول وجود علاقة ما بين معدل حدوث مرض اللوكيميا بين الاطفال في البصرة و مواقع انتشار محطات انتاج الطاقة الكهربائية. لكن يبقى هناك نقص في المعرفة العلمية له . هذا يوضح مدى الحاجة الى عمل دراسات تحليلية لمعرفة احتمالية وجود تأثير مسرطن للتعرض السكني الى الاشعة الالكترومغناطيسية.