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The Association Between Lifestyle and Incidence of Leukemia in Adults in Ahvaz, Iran

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Abstract

Background: Khuzestan province has faced a sharp increase of leukemia incidence and mortality during the recent years. Many studies have investigated the risk factors associated with leukemia, but inconsistent findings have been reported. To the best to our knowledge, no other study has assessed the association between lifestyle and incidence of leukemia in Ahvaz province, Iran.
Objectives: This study was conducted to investigate the association between lifestyle and incidence of leukemia in adults in Ahvaz, located in southwest Iran.
Patients and Methods: This case-control study was conducted on 80 adult patients with leukemia (referred to Shefa and Golestan hospitals in Ahvaz, Iran in 2014 - 2015) and 80 healthy individuals matched by gender and age. The data was collected by a researcher-created questionnaire assessing individual demographics and some lifestyle-related factors, and was analyzed by descriptive statistics and a chi-square test, using SPSS16.
Results: Exposure to radiation (P = 0.0001), chemicals (P = 0.02), pesticides (P = 0.01), and contact with pets or livestock (P = 0.0001) were associated with the risk of leukemia, but a history of smoking (P = 0.19) and drinking alcohol (P = 0.59), as well as living close to power transmission and distribution lines (P = 0.25), showed no association with leukemia.
Conclusions: This study showed that some lifestyle factors, particularly exposure to radiation, chemicals, pesticides, and contact with pets or livestock, can play an important role in etiology of leukemia.

Keywords: Leukemia, Risk Factors, Lifestyle, Iran

1. Background

Leukemia is one of the most prevalent cancers in both males and females (1). It accounts for 8% of total cancer cases and involves all age groups, with varying prevalence and incidence rates (2). The global prevalence of leukemia is reported as 5.8 and 4.3 per 100,000 person-years in males and females, respectively (3). In developing countries such as Iran, an increasing trend of leukemia was reported in recent years (2). In particular, Khuzestan province has faced a sharp increase of leukemia incidence and mortality since 2002 (4). Talaiezadeh et al. have reported that leukemia was the most common blood malignancy in both genders from 2002 - 2009. Based on their study, the prevalence of leukemia (lymphoid type) was 4 and 2 per 100,000 person-years in male and female, respectively (5). In another study conducted by Amoori et al. leukemia was one of the most common cancers during 2004 - 2008, and its prevalence was reported as 12.6 in males and 8.1 in females (per 100,000 person-years) (4).

In leukemia, the bone marrow produces too many blood cells which are different from normal blood cells and which do not function properly. Consequently, the production of normal white blood cells is discontinued and the individual's ability to fight infections is destroyed. Leukemia cells also affect the production of the red blood cells that carry oxygen to body tissues and blood platelets that prevent blood clotting (6). Some signs and symptoms of leukemia include anemia, bruising, swelling and bleeding of gums, mild fever, swollen lymph nodes, bone pain, severe and frequent bleeding, and presence of blood in the urine or stool (7).

The etiology of leukemia has not yet been clearly explained, but it seems that genetic and environmental factors are likely to contribute to its incidence (8, 9). Lifestyle factors, including exposure to radiation or certain chemicals such as benzene, smoking, alcohol use, viral infections, hereditary diseases, race or ethnicity, gender, family history, region of residency, and obesity are some documented risk factors for the development of leukemia in adults (10-13). Most studies have confirmed an association between smoking and risk of leukemia. Strom et al. considered smoking more than 30 cigarette packs as the main risk factor for males developing acute myeloid leukemia (AML) (14). Also, Musselman et al. found that smoking increased the risk of leukemia (15). For the association between drinking alcohol and the risk of leukemia, inconsistent findings have been obtained. Deschler and Lubbert demonstrated that a history of alcohol use was a factor of developing leukemia (16). In another study, Kroll et al. likewise showed that alcohol increased the risk of leukemia incidence (17). However, Rota et al. reported that drinking alcohol had no association with the risk of leukemia development (18).

Other risk factors have also been investigated. Akiba indicated that radiation exposure increased the risk of developing leukemia (19). Similarly, Linet et al. found that exposure to various forms of radiation was associated with increased risk of developing leukemia (20). The findings on the association between leukemia development and residence close to high-tension power lines have been inconsistent (21-23). Elliott et al. showed no association between the two variables in adults (21), but Feizi and Arabi found that residence close to high-tension power lines (less than 500 m away) and to strong magnetic fields (greater than 0.45 μT) was a risk factor for leukemia development in children (22). Also, Pedersen et al. found that residence close to high-tension power lines (between 200 - 599 m) partially increased the likelihood of leukemia incidence in children (23).

Recent studies have also reported an association between exposure to pesticides and the risk of leukemia incidence (24-26). Jin et al. concluded that exposure to pesticides increased the risk of developing myeloid leukemia (24), and Rajabli et al. reported higher prevalence of leukemia in rural areas due to exposure to chemicals and pesticides (25). Many other studies have confirmed this association: Hadi et al. reported that exposure to chemicals was a risk factor of developing leukemia (13), and Tsai et al. demonstrated that working in industrial plants and exposure to chemicals increased the risk of developing AML (27). Finally, for the association between contact with animals and risk of leukemia incidence, some studies have confirmed that there is an association between previous contact with animals and the risk of leukemia development (13, 28). Fritschi et al. showed that people who came in contact with livestock were at a higher risk of leukemia development (28).

Studying the factors contributing to development of diseases could play an important role in prevention. Today, preventive approaches have a higher priority than therapeutic ones, in an effort to reduce healthcare costs and promote psychosocial health. Assessing the risk factors of leukemia in different regions is likewise crucial for policy makers, who need to know the risk factors of this cancer in each region to design comprehensive prevention plans (29). Nurses have a particularly important role in the prevention and control of chronic diseases such as cancer, both through screening and through increasing public awareness about risk factors (30).

2. Objectives

Given that there are various risk factors involved in the etiology of leukemia, and that there may be substantial discrepancies between developed and developing countries, it is important to assess these risks in different regions. It seems necessary for each region to illuminate the risk factors of diseases in its own population. As mentioned above, Khuzestan province has faced a sharp increase in leukemia incidence and mortality during recent years (4, 5). This province is located in southwest Iran, and shares a border with Iraq. Major environmental changes due to the second war on Iraq in 2003 directly affected this province. Today, little is known about risk factors of leukemia in this part of country. So, it is necessary to determine the risk factors of this cancer as a first step for planning and control. The present study aimed to investigate the association between lifestyle and incidence of leukemia in Ahvaz province, which is located near Khuzestan in southwest Iran, in 2014 - 2015.

3. Patients and Methods

This case-control study was conducted in the hematology ward of Shefa and Golestan hospitals in Ahvaz, Iran, in 2014 - 2015. Inclusion criteria include age above 15 years, confirmed diagnosis of leukemia by an oncologist, and the psychological ability to participate in the study.

Based on Strom et al.'s study (14) that assessed risk factors of AML in adults, and which showed 34% exposure to chemicals among leukemia patients compared to 14% in non-patients, we estimated a sample size of 68 based on the below sample size formula, with α = 5% and β = 0.2. To get more confident results we included 80 subjects in each group, so we assigned 80 participants to the case group and 80 to the control group.

$$(1)\quad n=\frac{\left(z_{1-\frac{\alpha}{2}}+z_{1-\beta}\right)^2\left[p_1(1-p_1)+p_2(1-p_2)\right]}{(p_1-p_2)^2}=\frac{(1.96+0.85)^2\left[0.34\left(1-\frac{0}{34}\right)+0.14(1-0.14)\right]}{(0.34-0.14)^2}=68.05$$

The patients in the case group were randomly enrolled with reference to the number of available medical files and by a random numbers tabulation, if they met the inclusion criteria. If some of the enrolled participants declined to continue participation in the study, enrollment continued until the required number of participants was obtained. Each participant in the case group was asked to recruit an individual without leukemia (for example, a friend from childhood, neighbor, or acquaintance) close in age (± 2 years) to the participant and the same gender as the participant. As some participants failed to do so, the researcher recruited and enrolled the remaining healthy individuals from the local community, matching the age and gender of the case group participants.

After an explanation of research purposes, the subjects were asked to fill out a consent form. Data was collected based on interviews and patients' records, using a researcher-created questionnaire. This questionnaire included demographic data (age, gender, ethnicity, marital status, economic status, occupation, and educational level) and questions about lifestyle conditions (smoking, alcohol, pets, exposure to radiation, exposure to chemicals and pesticides, and residence close to high-tension power lines). In order to determine the scientific validity of this questionnaire, content validity assessment was used. For this purpose, after studying books and other resources related to this subject, a checklist of variables was prepared and then presented to 10 faculty members of the nursing school of Ahvaz Jundishapur University of Medical Sciences. Based on their feedback, the final checklist was prepared. Data was collected by the questionnaire and simultaneous interviews run by the researcher.

Data was analyzed by descriptive (frequency, percentage, mean, standard deviation, and frequency distribution tabulation) and analytical (chi-square and logistic regression) statistics, using SPSS software version 16. The level of significance was considered 0.05 with a confidence interval of 95%.

3.1. Ethical Considerations

This study was conducted after obtaining the approval of the Ahvaz Jundishapur ethics committee (Ajums. REC.1393.80), and informed consent from all subjects participating in the study.

4. Results

Demographic characteristics showed no significant difference between the case and control groups ($P > 0.05$). A chi-square test indicated no significant association between leukemia incidence and gender, occupation, economic status, education level, marital status, or ethnicity (Table 1). For the other potential risk factors, no significant association was seen between leukemia development and previous smoking ($P = 0.19$), previous alcohol use ($P = 0.59$), and residence close to power lines and telecommunication distribution networks ($P = 0.25$). However, a significant association was observed between leukemia development and previous exposure to radiation (radiology, etc.) ($P = 0.0001$), pesticides ($P = 0.01$), chemicals ($P = 0.02$), and contact with livestock or pets ($P = 0.0001$) (Table 2).

Table 1. Demographic Data for Case and Control Groups

Variables	Case (80 Subjects)[a]	Control (80 Subjects)[a]	P Value
Gender			0.11
Male	32 (40)	32 (40)	
Female	48 (60)	48 (60)	
Education			0.66
Less than high school	18 (22.5)	14 (17.5)	
High school	30 (37.5)	27 (33.7)	
Diploma	23 (28.7)	30 (37.5)	
College	9 (11.3)	9 (11.3)	
Marital status			0.61
Single	20 (25)	18 (22.5)	
Married	53 (66.3)	56 (70)	
Divorced (widowed)	7 (8.7)	6 (7.5)	
Ethnicity			0.40
Fars	50 (62.5)	55 (68.7)	
Arab	30 (37.5)	25 (31.3)	
Economic situation			0.49
Good	6 (7.5)	5 (6.3)	
Moderate	50 (62.5)	57 (71.2)	
Poor	24 (30)	18 (22.5)	

[a]Values are expressed as No. (%).

Table 2. Exposure to Risk Factors for Leukemia Between Case and Control Groups

Variables	Case (80 Subjects)[a]	Control (80 Subjects)[a]	P Value
Smoking			0.19
Yes	23 (28.7)	16 (20)	
No	57 (71.3)	64 (80)	
Alcohol			0.59
Yes	9 (11.2)	7 (8.8)	
No	71 (88.8)	73 (91.2)	
Exposure to radiation			0.0001
Yes	59 (73.8)	37 (46.2)	
No	21 (26.2)	43 (53.8)	
Pesticides			0.01
At no time	13 (16.3)	24 (30)	
Low	46 57.5)	48 (60)	
Upper intermediate	21 (26.2)	8 (10)	
Chemicals			0.02
At no time	22 (27.5)	39 (48.7)	
Low	36 (45)	31 (38.8)	
Upper intermediate	22 (27.5)	10 (12.5)	
Pets			0.0001
Yes	54 (67.5)	32 (40)	
No	26 (32.5)	48 (60)	
Residence close to high-tension power lines			0.25
Yes	34 (42.5)	27 (33.8)	
No	46 (57.5)	53 (66.2)	

[a]Values are expressed as No. (%).

5. Discussion

Most participants in the two groups had not smoked, and there was no significant association between history of smoking and leukemia incidence, but the history of smoking in the case group (28.7%) was higher than in the control group (20%). Strom et al. demonstrated that smoking more than 30 cigarette packs was the main risk factor for developing AML in males (14). Hadi et al. considered smoking for over 10 years to be a risk factor of leukemia development (13). Musselman et al. also found that smoking increased the risk of leukemia (15). The present study's findings are not consistent with these studies, which could be explained by the difference in the subjects and regions. Most subjects in this study were female, and the prevalence of smoking is predictably less in females.

Most participants in the two groups had no previous alcohol use and there was no significant association between drinking alcohol and leukemia incidence, but alcohol use was higher in the case group (11.2%) than in the control group (8.8%). Rota et al. found that drinking alcohol was not associated with the risk of leukemia development (18), which is in line with the present study. Deschler and Lubbert demonstrated that previous alcohol drinking was a factor of leukemia incidence (16). Also, Kroll et al. found that drinking alcohol increased the risk of leukemia incidence (17). Again, the present findings are not consistent with these investigations. The discrepancy may be due to the difference in the subjects and regions. Most participants in the study were female, and the prevalence of alcohol drinking is smaller among females. In addition, alcohol drinking is more common in western countries than in Iran because of religious and cultural considerations.

History of exposure to radiation (radiology, etc.) in the case group (73.8%) was higher than the control group (46.2%), and there was a significant association between history of exposure to radiation and leukemia incidence. In other words, the rate of leukemia incidence was higher in the individuals with previous exposure to radiation. Deschler and Lubbert demonstrated that previous exposure to radiation was a factor for developing leukemia (16), and Akiba indicated an increased risk of developing leukemia because of radiation exposure (19). Furthermore, Linet et al. showed that exposure to various types of radiation was associated with the risk of leukemia incidence (20). These studies are all in line with the findings of this study.

The majority of participants in the two groups did not live near power lines or telecommunication distribution networks, but the number of participants who lived in these settings was higher in the case group (42.5%) compared to the control group (33.8%). There was no significant association between living close to power transmission and distribution lines and leukemia incidence. Elliott et al. likewise showed no association between living close to high-tension power lines and magnetic fields and the risk of cancer development in adults (21). However, Feizi and Arabi found that living close to high-tension power lines (less than 500 m) and magnetic fields (greater than 0.45 μT) was a risk factor of leukemia incidence in children (22). Also, Pedersen et al. indicated that living close to high-tension power lines (between 200 - 599 m) slightly increased the likelihood of leukemia incidence in children (23). The previous studies' focus on leukemia risk in children may explain the inconsistent findings. Also, in two studies the distance from the residence to high-tension power lines was calculated numerically, but the present study did not calculate this distance.

History of exposure to pesticides in the case group (26.2%) was higher than in the control group (10%), and a significant association was seen between history of exposure to pesticides and leukemia incidence. The Deschler and Lubbert study determined that previous exposure to pesticides was a factor in leukemia incidence (16). Similarly, the Jin et al. cohort study demonstrated that exposure to pesticides increased the risk of myeloid leukemia incidence (24), and Rajabli et al. reported that the prevalence of leukemia was higher in rural areas because of exposure to pesticides (25). These studies are in agreement with the findings of the present study.

History of exposure to chemicals in the case group (27.5%) was also higher than the control group (10%), and a significant association between history of exposure to chemicals and development of leukemia was seen. Hadi et al. reported that exposure to chemicals was a risk factor of developing leukemia (13). Strom et al. found that occupational exposure to chemicals was a main factor of AML incidence (14). Tsai et al. similarly demonstrated that working in industrial plants and exposure to chemicals caused an increase in the risk of AML development (27). Rajabli et al. demonstrated that leukemia prevalence was higher in villages because of exposure to chemicals (25). These studies confirm the findings of the present study.

Most participants in the case group reported previous contact with pets or livestock, and a significant association was seen between previous contact with livestock or pets and leukemia incidence. In other words, the rate of leukemia incidence in the individuals with previous contact with livestock or pets was higher than in other individuals. Hadi et al. found previous contact with animals to be a risk factor of leukemia development (13). Deschler and Lubbert demonstrated that a history of contact with animals was a factor in leukemia incidence (16). Fritschi et al. reported that individuals in contact with livestock were at a higher risk of developing leukemia (28). These findings are consistent with the present study.

To the best to our knowledge, this is the first research assessing the association between lifestyle and the incidence of leukemia in Ahvaz province. In case-control studies, recall bias could affect the results, and this study is not exempt from this problem. Furthermore, since this study was conducted on a limited sample and in a specific city, the generalizability of the findings might be reduced. So, it is recommended that further studies be performed with larger sample sizes and in other provinces.

5.1. Conclusions

Based on the results, there wasn't a significant difference between the case and control groups regarding a history of smoking and drinking alcohol, or in terms of living close to power transmission and distribution lines. However, significant differences were revealed between the two groups in exposure to radiation, chemicals, and pesticides, and in contact with pets or livestock.

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Footnotes

Authors' Contributions: Study concept and design: Zeinab Ahmadi, and Abdol Ali Shariati; analysis and interpretation of data: Mahmood Latifi; manuscript preparation: Zeinab Ahmadi and Abdol Ali Shariati; collection of data: Zeinab Ahmadi; critical revision: Sedighe Fayazi.

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