Epidemiology and Risk Factors of Cancer Among Children and Adolescents in Sulaimani City: A Case-Control Study

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Abstract- Cancer can be defined as an abnormal growth of cells that can spread inside the body and affect many tissues and organs in different forms. It is a group of diseases that happen when abnormal cells grow and spread quickly. The purpose of the study was to determine the prevalent types of cancer and the risk factors associated with disease among children in Sulaimani city. The main part of this research was a hospital-based case-control study. The sample included 100 children aged 0-16 years (50 cases and 50 controls). The study was conducted in Sulaimani Hiwa Hospital and Pediatric Teaching Hospital from 1st January to 1st May 2018. Data on the exposed risk factors were obtained from face to face interview with the mother's cases and controls. Data was entered into Epidat version 3. Data were analyzed using STATA 11. Descriptive and percentages were used for Socio-demographic variables, odds ratios were used to determining potential risk factors, and *P* less and equal to 0.05 was estimated as statistically significant. The mean age of children was 46.2 (SD 42.7) months and the mean age of the mothers at the time of pregnancy was 28.4 (SD 6.7) years. Overall, there were 61 males and 39 females in the study. The commonest types were ALL (30%) while the less common types were osteosarcoma (4%). The risk factors linked to cancer were cesarean section (odds 2.7, *P*=0.02), family history (odds 10.8, *P*=0.008), mothers exposed to pesticides and chemicals during pregnancy (odds 3.0, *P*=0.01), (odds 6, *P*=0.0006) respectively, children exposed to pesticide (odds 5.4, *P*=0.02), exposed to passive smoke have similar odds (odds 3.0, *P*=0.01). Children's caffeine consumption (odds 2.3, *P*=0.04) and fast food (odds 3.0, *P*=0.01). In general, to control and prevent cancer among children, it is highlighting the need for communication and education mothers to aware about potential risk factors that lead to cancer. Furthermore, studies with larger sample size are required to determine other risk factors for cancer

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Introduction

Childhood cancer (also known as pediatric cancer) is most commonly defined as cancer in a child and sometimes including adolescents between 15-19 years of age. World Health Organization (WHO) has defined cancer as a condition where the cells and tissue of all body organs are growing uncontrollably (1,2). The common causes of childhood cancers are unknown. Almost 5% of all cancers in children are linked to genetic factors (a mutation that can be passed from parents to their children) (3). Cancer incidence rises speedily worldwide, especially in developing countries. Cancer incidence varies according to the type of cancer, sex, age, and racial and ethnic group. Overall, cancer incidence in children varies from 100 to 180 per million children under 15 years of age (4). Accordingly, the total incidence rate of cancer in children varies between 50 and 200 per million children globally. In fact, Childhood cancer is rare, and the rate of new cases is 15.3 per

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100.000 per year (5). There are a variety of cancer types that can occur in both children younger than 15 years of age as well as in adolescents up to age 19 years (6). The most serious adverse health outcomes of childhood cancer or its treatment result in death. Cancer is considered as one of the most common causes of disease-related mortality in children 1-19 years of age (7). The common types of childhood cancer include leukemia which is the common childhood cancer, accounting for about 25% of all cancers. The two main types of child leukemia involve acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML). The second type which accounted for 17% is central nervous system tumors (brain tumors) followed by lymphomas (cancer of the lymphatic system) which accounted for about 16% of cancer occurring before age 20 which categorized to Hodgkin's disease and non-Hodgkin's lymphoma (8,9). The less common types of childhood cancer include malignant epithelial neoplasm, soft tissue sarcoma, osteosarcoma, and other types unspecified (8). There are a variety of environmental risk factors linked to cancer, pesticide is one of the hazardous substances linked to cancer disease; exposures during childhood to unspecified residential pesticides and insecticides were also positively associated with childhood cancer, children may expose to pesticide due to contaminated ground and surface water from agriculture runoff or because of living near the agriculture area or used at home (10,11). Certain chemical substances and diets rich in red meat and other animal products are also associated with increased cancer risk," Caffeine can potentially affect the pathways of cancer (12). Besides, drinking alcohol and tobacco smoking are both associated with increased risk of cancer (13). Radiation is other risk factors linked to cancer disease especially for all types of leukemia. Being exposed to radiation from an industrial accident or radiotherapy is associated with an increased risk for cancer (14). Congenital anomalies are at increased risk of cancer (15). Prevention and controls of cancer depend on the two important prevention strategies, the first action is by elimination risk behavior and the second is an early diagnosis of cancer by applying for the screening program. In addition, increasing physical activity, reducing exposure to and use of tobacco, reducing exposure to ultraviolet light and reducing exposure to the chemical substance may prevent from the disease (16). The current study was undertaken to determine the potential risk factors associated with cancer and the most common types distributed among children.

Materials and Methods

The hospital-based case-control study was conducted in Sulaimani Hiwa Hospital and Pediatric Teaching Hospital from 1st January to 1st April 2018 on the 100 children (50 cases and 50 controls) aged between 0-16 years. Hiwa Hospital is one of the largest and main cancer hospitals in Sulaimani city which provides services in a wide range of specialties for cancer patients for those who have been referred from other hospitals and private clinics, in addition, the Pediatric Teaching Hospital is the main public pediatric hospital in Sulaimani city which provides services in a wide range of specialties for children from aged 0-12 years. A standardized pre-test questionnaire was used in this research. A pilot study was done prior to this investigation to validate the questionnaire. Data on the risk factors was obtained by face to face interview with the mother's cases and controls using a questionnaire after explaining the aims of the study and informed consent was taken from each mother. The study was approved by the ethics committee of the Technical College of Health-Community Health Department and permission were also taken from the Hiwa Hospital and Pediatric Teaching Hospital. Cases were selected when admitted to Hiwa Hospital either for initial diagnosis or follow-up and treatment. Children diagnosed with cancer whether newly or previously who visited the Hiwa Hospital for follow-up and checks during the period of study were recruited as cases. Controls were selected using a systemic random selection from a list of all new admissions to the Pediatric Teaching Hospital on a daily basis admitted with the same age and during the same period in the Pediatric Teaching hospital for other conditions (without cancer). Cases and controls aged over 16 years and residents outside Sulaimani city were excluded from the study. Data were analyzed using Stata version 12. Categorical variables were described using frequencies and percentages. While for numeric variables mean and the standard deviation was used for those normally distributed variables and odds ratios were calculated for potential risk factors using logistic regression in Stata version 11. *P* equal to and less than 0.05 was considered statistically significant for all analysis, and smaller *P* was reported as <0.001, if it was less than 0.001.

Results

The sample of 100 children was recruited in the study, 50 children with cancer and 50 children without cancer with the mean age of 46.2 (SD 42.7) months with the range of 2 to 192 months and the mean age of the mothers at time of pregnancy 28.4 (SD 6.7) years with the range 18-41 years . Overall, there were 61 males and 39 females. Of those who had cancer, 29 (58%) were males, and 32 (64%) were females. In the control groups, there were 21(24%) males, and 18 (36%) were females table 1.

Table 1. Mean age of children and mothers

Age	Number	Mean	SD	Minimum	Maximum
Child age (months)	100	46.2	42.7	2	192
Mother's age at the time of pregnancy (year)	99	28.4	6.7	18	41

Figure 1 shows the proportion of participants, (40%) of cases were from inside the city and (60%) were from outside. Controls were (74%) from inside the city, while 26% from outside the city.

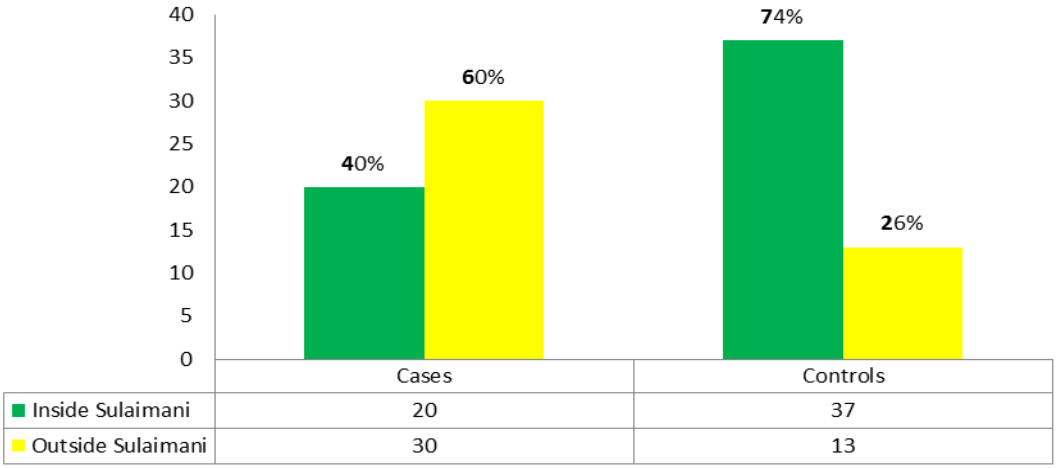

Figure 1. Place of residence of participants in the study

Ethnicity distribution of the children, as shown in figure 2, the vast majority of the children of cases and controls participated in the study was Kurd (86% VS.100%) followed by 14% of cases were Arab.

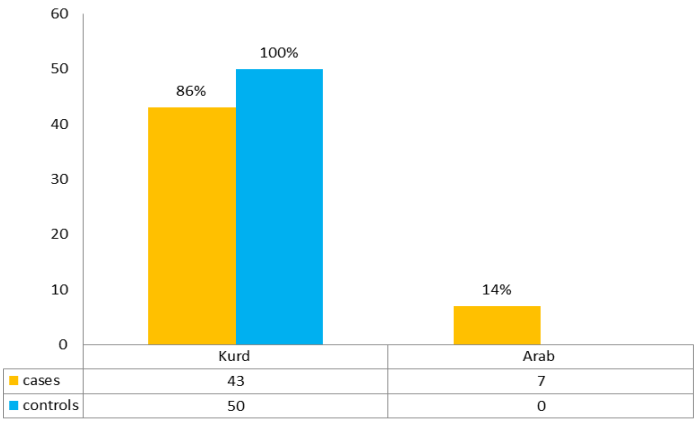

Figure 2. The ethnicity of children participants in the study

Figure 3 shows the frequency distribution of cancer among children. The commonest types were ALL (30%) and other cancer (26%), followed by the less common types lymphoma (14%), Neuroblastoma (12%), Lymphoma (6%) in our series.

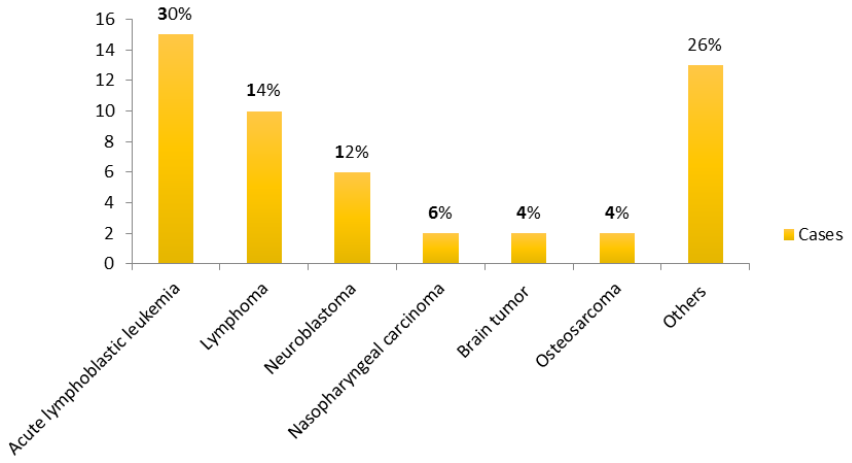

Figure 3. Frequency distribution of cancer

The study investigated a range of different risk factors for their potential association with childhood cancer. We classified these risk factors into three categories, which are socio-demographic risk factors, pregnancy-related risk factors, and environmental risk factors. A number of socio-demographic characteristics of cancer cases and controls, for both groups, are presented in table 2.

Table 2. Frequency distribution and association of sociodemographic risk factors and comparison of cases and controls

Characteristics		Cases (n=50)	Controls (n=50)	*P*
Gender	**Male**	29 (58%)	21 (42%)	0.5
	Female	32 (64%)	18 (36%)	
Mother occupation	**Employee**	9 (18%)	41(82%)	0.5
	Non-employee	12 (24%)	38 (76%)	
Mothers education	**Education**	31 (62%)	19 (38%)	0.003
	None education	44 (88%)	6 (12%)	
Fathers education	**Education**	44 (88%)	6 (12%)	0.1
	None education	48 (96%)	2 (4%)	
Family history	**Yes**	9 (18%)	1 (2%)	0.008
	No	41 (82%)	49 (98%)	
Mother's age	**≤25**	10 (20%)	18 (36%)	0.1
	26-35	7 (14.2%)	9 (18%)	
	≥36	32 (65%)	23(46%)	

Among mothers cases (18%) were employed and (24%) were none employed, while mother's controls (82%) were employed and (76%) were none employed this result was statistically not significant *P*=0.5. In relation to parental education, higher percentages of mother's cases (88%) were uneducated, while the

controls were (12%) the *P*=0.1. There was a similarity between educated and uneducated fathers of cases and controls (96% VS. 88%) respectively. In regard to family history, (18%) of cases and (2%) of controls had a positive family history, while (82% of cases, VS. 98% of controls) had the negative family history the results were statistically significant *P*=0.008. Mothers aged <25 cases were (20%), and controls were (36%), the age 26-35 years of mother's cases and controls was (14.2% VS. 18% respectively) while the age 35 and over (65%) was cases (46%) as controls. These results were not significant *P*=0.1.

Regarding the mode of delivery, it was found significantly associated with having a child with cancer, while (38.5%) of mother's cases have a normal vaginal delivery, (62.5%) have a caesarian section. these percentages (61.5%) have a normal delivery and (37.5%) have a cesarean section in mothers of control. In respect to the term of pregnancy, mothers having a child before completing months of pregnancy, cases were (54%), and controls were (20%), while among mothers have full term of pregnancy cases were (46%), and controls were (80%), this difference was statistically significant *P*=<0.0001 .

Among mothers who had normal weight during pregnancy, cases were (27.8%), and controls were (20.6%), while mothers who were overweight cases were (55.6%) and controls were (44.1 %,) and obese women (16.7% were cases, 35.3% were controls). In term of gestational diabetes, there was no difference between mother cases and controls (8% VS. 12%). The remaining risk factors are presented in table 3.

Table 3. Frequency distribution of exposure to environmental risk factors during pregnancy and comparison of cases and controls

Characteristics		Cases (n=50)	Controls (n=50)	*P*
Mode of delivery	**Normal vaginal delivery**	20 (38.5%)	32 (61.5%)	0.02
	Caesarian section	30 (62.5%)	18(37.5%)	
Terms of pregnancy	**Neonates at term (39-41) weeks**	23 (46%)	40 (80%)	<0.0001
	Neonates at pre-term ≤38 weeks	27 (54%)	10 (20%)	
Child order	**1**	11 (22%)	22 (44%)	0.05
	2	9 (18%)	9 (18%)	
	>3	30 (60%)	19 (38%)	
Maternal weight (BMI) during pregnancy*	**Normal weight 18.5-24 kg/m^2**	10 (27.8%)	7 (20.6%)	0.2
	Overweight 25-29 kg/m ^{2}	20 (55.6%)	15 (44.1%)	
	Obese ≥30 Kg/ m ^{2}	6 (16.7%)	12 (35.3%)	
Maternal illness	**Yes**	14(48.3%)	15(51.7%)	0.8
	No	36(50.7%)	35(49.3)	
Gestational diabetes	**Yes**	4 (8%)	6 (12%)	0.5
	No	46 (92%)	44 (88%)	

Table 4 shows that the environmental risk factors of children were associated with cancer. In respect to child relative, children cases having relatives with cancer were (60%) and controls (22.5%), while children cases with no relatives suffering from cancer were (40%) and controls were (77.5%). A child with the congenital disease was statistically significantly associated with the presence of cancer, cases were (26%), and controls were (8%). Frequently Consumption of fast food was significantly associated with cancer disease (40%) cases and (18%) controls, while among those who did not have cancer cases were (60%) and controls were (82%). Birth weight was associated with cancer, low birth weight was significantly related to cancer, cases were (36%), and controls were (20%), while those have been born with normal weight the cases were (64%) and controls were (80%), *P*=0.08.

Table 4. Distribution of exposure to environmental risk factors of children and comparison of cases and controls

Characteristics		Cases (n=50)	Controls (n=50)	*P*
Child relative to cancer	**Yes**	30 (60%)	11 (22.5%)	<0.0001
	No	20 (40 %)	38 (77.5%)	
A child with congenital diseases	**Yes**	13 (26%)	4 (8%)	0.02
	No	37 (74%)	46 (92%)	
Child with syndrome	**Yes**	2 (4%)	5 (10%)	0.3
	No	48 (96 %)	45 (90%)	
Junk food consumption by a child	**Yes**	20 (40%)	9 (18%)	0.02
	No	30 (60%)	41 (82%)	
A child exposed to x-ray	**Yes**	15 (30%)	10 (20%)	0.2
	No	35 (70%)	40 (80%)	
Child birth weight	**Low birth weight g< 2500**	18 (36%)	10 (20%)	0.08
	Normal birth weight g> 2500	32 (64%)	40 (80%)	

The odds ratios of variables found to be associated with cancer were calculated and are shown in table 5. The result shows infants being borne by caesarian section comparing to infants being born by normal vaginal delivery was significantly at risk of having cancer with odds ratio 2.7 (95% CI: 1.15-6.15, χ2:5.7, *P* 0.02). In terms of pregnancy, children born prematurely were more likely at greater risk than children born on time to have cancer the odds ratio 4.7 (95% CI: 1.8-12.2, χ2:12.7, *P* 0.0005). Children at greater risk of having cancer if they have a positive family history of cancer compared to those with negative family history (the odds ratio: 10.8,95% CI: 1.2-96.7, χ2:7.04, *P* 0.008). Regarding child relative, children who had relatives with cancer disease were more likely at greater risk than those who did not have relatives with cancer disease (OR 5.2 95% CI: 1.2-13.5, χ2:5.7, *P* 14.3). Children with congenital anomalies were significantly at greater risk compared to those children with the absence of congenital anomalies OR 4.1 (95% CI: 1.2-14.0, χ25.7, *P* 0.02). Mothers who didn't take folic acid before pregnancy was significantly at risk of giving birth to children with cancer disease compared to those who had taken folic acid OR 3.5(95% CI: 1.5-8.3, χ2:8.9, *P* 0.003). Mothers and children who were exposed to second-hand smoke were significantly at greater risk compared to those mothers and children were not exposed to secondhand smoke OR 3 (95% CI: 1.22-7.5, χ2:6.35, *P* 0.01) and 3 (95% CI: 1.2-7.5, χ2:6.4 *P* 0.01), respectively. Children who were born from mothers exposed to radiation during pregnancy were 3 times at risk than those children were born from mothers who didn't expose to radiation OR 3 (95% CI: 1.22-7.5, χ2:5.2, *P* 0.02). In respect to exposure to chemicals during pregnancy, children who were born from mothers exposed to the chemical during pregnancy were significantly at greater risk compared to those children born from mothers who were not exposed to chemicals during pregnancy OR 6(95% CI: 1.9-19.2, χ2:11.9, *P* 0.0006). Mothers who were exposed to pesticide during pregnancy, their children were at greater risk of developing cancer compared to those children who were born from mothers who were not. Likewise, children who were exposed to a pesticide were at risk of developing cancer compared to those children who were not OR 3 (95% CI: 1.22-7.5, χ2:6.32, *P* 0.01, OR 5.4 95% CI: 1.6-18.8, χ2:8.91, *P* 0.02 respectively). Caffeine and fast food consumed by the children was found significantly associated with the developing of cancer disease compared to those who didn't so OR 2.3(95% CI: 1.0-5.4, χ2:4.2, *P* 0.04) and OR 3.0(95% CI: 1.2-7.9, χ2:5.8 *P* 0.01) respectively.

Table 5. Odds ratio and 95 % confidence interval for significant sociodemographic, pregnancy-related risk factors and environmental-related risk factors associated with cancer

Risk factors		Odds ratio (95% CI)	*P*	Chi-square
Mode of delivery	**Normal vaginal delivery** **Caesarian section**	Reference 2.7(1.15-6.15)	0.02	5.7
Terms of pregnancy	**Neonates at term (39-41) weeks Neonates at pre-term ≤38 weeks**	Reference 4.7 (1.8-12.2)	0.0005	12.27
Family history	**Yes** **No**	Reference 10.8 (1.2-96.8)	0.008	7.04
Child relative with cancer	**No** **Yes**	Reference 5.2 (1.2-13.5)	0.0002	14.3
A child with congenital diseases	**No** **Yes**	Reference 4.1 (1.2-14.0)	0.02	5.7
Consumption of junk food by a child	**No** **Yes**	Reference 3.0 (1.2-7.9)	0.01	5.8
Mother's Second-hand smoke during pregnancy	**No** **Yes**	Reference 3.0 (1.22-7.5)	0.01	6.4
A child exposed to second-hand smoke	**No** **Yes**	Reference 3.0 (1.2-7.5)	0.01	6.4
Maternal exposure to radiation during pregnancy	**No** **Yes**	Reference 3.5 (1.11-11.0)	0.02	5.2
Chemical exposure during pregnancy	**No** **Yes**	Reference 6.0 (1.9-19.2)	0.0006	11.9
Mothers exposed to pesticide	**No** **Yes**	Reference 3.0(1.22-7.5)	0.01	6.35
A child exposed to pesticide	**No** **Yes**	Reference 5.4(1.6-18.8)	0.002	8.91
Children consumption caffeine	**No** **Yes**	Reference 2.3(1.0-5.4)	0.04	4.2
Pre-consumption folic acid for pregnancy	**Yes** **No**	Reference 3.5(1.5-8.3)	0.003	8.9

The remaining risk factors that are not significantly associated with cancer are presented in table 6. Folic acid intake during pregnancy, gestational diabetes, exposure to sunlight, caffeine consumption during pregnancy, maternal age, BMI and so on for other risk factors that show in the table 6.

Table 6. Odds ratio and 95 % confidence interval for non-significant sociodemographic, pregnancy-related risk factors and environmental risk factors associated with cancer

Risk factors		Odds ratio (95% CI)	*P*	Chi-square
Folic acid consumption during pregnancy	**No** **Yes**	Reference 1.57(0.3-1.4)	0.2	1.64
Caffeine consumption by the mother	**No** **Yes**	Reference 0.7(0.3-1,6)	0.4	0.7
Use of contraceptive by mother	**No** **Yes**	Reference 0.7(0.3-1.7)	0.5	0.36
Frequent sun exposure	**No** **Yes**	Reference 0.9(0.4-2)	0.8	0.04
Illness during pregnancy	**No** **Yes**	Reference 0.9(0.4-2.1)	0.8	0.05
Child with syndrome	**No** **Yes**	Reference 0.4(0.06-2.1)	0.3	1.4
Maternal gestational age	**No** **Yes**	Reference 0.6(0.2-2.4)	0.5	0.4
BMI during pregnancy	**Normal weight 18.5-24 kg/m^2** **Overweight 25-29 kg/m^2** **Obese ≥30 kg/m^2**	Reference 1.1(0.3-3.5) 2.9(0.7-12.1)	 0.9 0.1	 0.01 2.2

Table 7. Adjusted odds ratio and 95% confidence intervals for risk factors significantly associated with cancer

Risk factors		Adjusted Odds ratio	*P*	95% CI	Trend *P*
Mode of delivery adjusted for gestational age	**No**	Reference	0.0002	(1.4-9.3)	0.005
	Yes	3.58			
Gestational age adjusted for mode of delivery	**No**	Reference	0.0002	(2.1-18.1)	0.0002
	Yes	6.1			
Gestational age adjusted for birth weight	**No**	Reference	0.0005	1.8-12.7	0.0005
	Yes	4.8			
Mode of delivery adjusted for birth weight	**No**	Reference	0.02	1.2-6.3	0.02
	Yes	2.7			
Child relative with cancer adjusted with child congenital anomalies	**No**	Reference	0.0004	1.8-12.7	0.0004
	Yes	4.8			

In order to estimate pairs of variables associated with each other, we calculated the adjusted odds ratio (Table 7). When we adjusted the mode of delivery, gestational age remained statistically significantly associated with cancer (aOR: 3.85, 95% CI 1.4-9.3, *P*=0.0002). After we adjusted gestational age, mode of delivery also remained statistically significantly associated with cancer (aOR: 6.1, 95% CI: 2.1-18.1, *P*=0.0002). In respect to gestational age, birth weight. gestational age remained statistically significantly related to cancer (aOR: 4.8, 95% CI: 1.8-12.7, *P*=0.0005). In addition, when we adjusted the mode of delivery, birth weight remained a significant risk factor for cancer (aOR: 2.7 95% CI: 1.2-6.3, *P*=0.02). Regarding child relative with cancer adjusted with a child with congenital anomalies remained a greater risk factor for cancer (aOR: 4.8, 95% CI: 1.8-12.7, *P*=0.0004).

Discussion

Child cancer (also known as pediatric cancer) a disease caused by the uncontrolled division of abnormal cells in a part of the body. Our study revealed a number of risk factors that are associated with cancer in children as mode of delivery, terms of pregnancy, family history, having relatives with cancer, child with congenital disease, consumption of caffeine and junk food by the children, mothers and children exposed to secondhand smoke, radiation, and pesticides, mothers exposed to chemicals and failure to take folate before pregnancy. Our study result revealed the commonest types of childhood cancer in Sulaimani city was Acute Lymphoblastic Leukemia (ALL) followed by the less common were brain tumors and osteosarcoma. It is similar to the study which was conducted in Northeast Iran (17) and the study which was conducted in Avicenna hospital in Sari, Iran between 2001-2010 (18). While it is in contrast with the study of India and Fars (19,20). The interpretation of these results may be variation in the patterns of cancer , different geographical areas, and the lifestyle. The findings of our study showed the cesarean section is significantly associated with the presence of cancer compared to those having children by normal vaginal delivery. We found this result was statistically significant when we adjusted the variables mode of delivery with gestational age (aOR: 3.85, *P*=0.0002). This result is in concordance with the studies which were done in Denmark, Sweden, and Finland (21). Premature children are 5 times at greater risk of having cancer disease in comparison to those who had been born on the time. When we adjusted gestational age with the mode of delivery, it remained statistically significant related to cancer (aOR: 6.1, *P*=0.0002). The result is in line with the study which was conducted in Sweden (22). However, there is also a study which is in contrast to our result (23). Positive Family history and children having relatives with cancer disease were at greater risk of being born with cancer disease. This result is compatible with the study which was done in the United States and Canada (24). Regarding the term congenital anomalies, children born with congenital anomalies were 4 times at greater risk of having cancer. This result was statistically significant when we adjusted the variables child relative with cancer with a child with congenital anomalies (aOR: 4.8, *P*=0.0004). This result is in concordance with the studies of three states of the United States of America (Utah, Arizona, and Iowa) and Iraq (25,26). Our study discovered that children consuming fast food are significantly at risk of having cancer in comparison to those who didn't so. It is similar to French-Sante cohort study in 2009 (27). Mothers' exposure to secondhand smoke was was significantly associated with cancer disease. It is in accordance with the study of

Harvard School of public health (28) and study which was done in Shanghai (29). In regards to pesticides, mother exposure to this types of the chemicals were 3 times at higher risk of having children with cancer disease, in addition, children exposed to pesticide are also 5 times at higher risk of having cancer. These findings are similar to the study (30) and another study which was done in Baltimore, MD, and SMSA (31). Our results showed that frequent consumption of caffeine by the children at an early age is associated with greater risk of cancer. The study which was conducted in Australia confirmed our results (32). Mothers' folate supplement especially 2 months before pregnancy may reduce the risk of having infants with cancer in comparison with mothers who didn't take folate supplement, and it is associated 4 times higher risk of cancer which is in concordance with a study reported by University of Florida (33). In our study, mothers exposed to radiation during pregnancy especially during the first trimester of pregnancy were 4 times at higher risk of having infants with cancer, this is in line with the study which was conducted in England (34). The remaining risk factors reported by this study had no statistically significant association with child's cancer (maternal gestational age, a child with the syndrome, illness during pregnancy, and frequent sun exposure). Our study had a number of limitations including small sample size and the probability of selection bias especially in the selection of controls. Mothers with no formal education might be prone to recall bias while collecting information. The study did not include all possible risk factors which limit comparison with other studies. Therefore, further studies with large sample size are required to investigate a wider range of risk factors

In conclusion, our study showed the commonest types of cancer was ALL (30%) and others type unspecified (26%), followed by the very less common types nasopharyngeal, brain, tumor, and osteosarcoma (4%), respectively in our series. Based on the results of this study, the most confirmed risk factors linked to cancer diseases include, maternal and children exposure to pesticide, chemical, and second-hand smoke, caffeine and frequent fast food consumption by children and , negligence of use folic acid before pregnancy, exposure to radiation during pregnancy, child having congenital anomalies, and premature delivery. According to the limited evidence about childhood cancer, future studies in Sulaimani should provide evidence about etiology, the effectiveness of screening and early detection of cancer. Highlighting the programs and policies in order to control and prevent risk factors .

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