

## Factors related to pediatric Burn in Iran: A Case-Control Study

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### Abstract

#### Background

Children are more likely to be burned than other age. The aim of this study was to determine the burn-related factors in children in Kermanshah province, Iran.

#### Materials and Methods

In the present hospital based case-control study, 198 under 15 years age children who were burned (from beginning of spring 2016 until the end of spring 2017), enrolled into the study as cases and 198 children referred to the hospital for non-burning reasons selected as controls. The cases and controls were frequency matched for age and gender variables. Principal Component Analysis test was used to construct the socioeconomic variable and univariate, moreover multivariate logistic regression tests were used to determine the burn-related factors. All analyses were carried out using SPSS software version 21.0.

**Results:** The mean age of children with burns was  $4.3 \pm 3.5$  years. The most common factor of burns was hot liquids with 48.5%. Body mass index (Odds Ratio (OR)=1.252, P= 0.004), number of household members more than 5 body (OR=8.472, P<0.001), absence of more than one watchful (OR=2.481, P=0.026), hours without watchful (OR=8.649, P<0.001), illiterate mother (OR=9.778, P=0.002), petroleum storage at home (OR=1.815, P=0.046), and the lowest quartile of socioeconomic level (OR=7.220, P<0.001) increased the chance of burning in children. Increase of mother age (OR=0.938, P=0.005) and the worker father (OR=0.233, P=0.002) reduced this chance.

**Conclusion:** Based on results of current study, burning in children is a multifactorial outcome including individual, social and environmental factors such as Body mass index, household size, mother age, father job, less watchful, hours without watchful, illiterate mother, petroleum storage at home, and socioeconomic status.

**Key Words:** Burn, Case-Control, Iran, Pediatric.

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## 1- INTRODUCTION

In recent years, by increasing the number of burn-related injuries, they are considered as an important and serious problem especially in the low-income and middle-income countries (1, 2). Children are more likely to be burned than other age groups because of their physics, lower risk perception, and slowness in responding to dangers and imitation of their parents' behaviors (3). However, with the advent of medical science, much of the burn problems have diminished, nonetheless, morbidity, mortality, and complications of burn among children are still a major challenge for nations (4). Burn is one of the most important consequences in children, which results in severe functional, social, and psychological disorders (5, 6). Such consequences in children are much more severe than adults (7). In 2008, more than 47,000 children under the 15 years age died from burn injuries in the worldwide (8). More than 90% of burn-related children deaths occur in low and middle-income countries (9).

Studies have shown that half of these deaths occur in Southern and Southeast Asia (10). Some of the burn risk factors in children include poverty, population density, and lower parental education, and maternal age, lack of watchful and environmental hazards (10, 11). Many of the burns that occur in the first two decades of the life are accidental and preventable (7). There is no information on the comprehensive epidemiology of burns in Iran. Only some surveys, which were conducted in some parts of the country, indicated that hot liquids and flames-related burns in young people, women and people with lower education levels were high (2, 12, 13). The study on the burden of diseases in Iran in 2003 showed that burns ranked 13 in a total of the population and ranked 7 in children aged 5-14 years (14). To the best of our knowledge, most of the internal

studies have not discussed the burns related factors (12, 15-21). Since the factors related to burn injuries in different areas can be different, successful preventive programs should be based on the necessities of each area (22). This study aimed to investigate the factors related to pediatric burn in Kermanshah province, Iran. The results of this research can be useful to prevention of burns in children for organizations such as the University of Medical Sciences, municipalities, health policymakers, etc.

## 2- MATERIALS AND METHODS

### 2-1. Study design and population

The present research is a hospital based case-control study which was conducted in Kermanshah province, West of Iran, with a population of about 2 million people. The data were collected over a period of 15 months (beginning of spring 2016 until the end of spring 2017).

### 2-2. Methods

Children under the age of 15 years old, who referred to the burn ward of Imam Khomeini Hospital (the only burn referral in Kermanshah province) from all regions of Kermanshah province, were included in the study as cases; and children who were admitted to Dr. Kermanshahi Hospital (the only specialist and subspecialist pediatric center in Kermanshah province) from all regions of Kermanshah province, were included as controls. Frequency matching was performed for two variables of age and gender. Data were collected by interviewing a trained person with the mother or the closest companion (with the mother's priority) based on a checklist that was prepared on the literature review and the opinion of some experts in this field.

#### 2-2-1. Case selection

In the present study, 198 children under 15 years of age (maximum 15 years, 11 months and 29 days) with an unintentional

burn were entered to study successively. Burns included cases of grade 1 above 15% burn, and all cases of grade 2 and 3 caused by hot liquids, hot objects, or flames. Intentional burns or natural disasters-related-burns were excluded from the study. Also, in the case of admitting a sibling of the case admitted to study, it was dropped from the list.

### 2-2-2. Controls

In order to choose a control group, 198 children under 15 years age in Kermanshah province that were referred to the Dr. Mohammad Kermanshahi Children's Hospital (A reference hospital in the province of Kermanshah) for various reasons other than burning (such as gastroenteritis, types of allergies, laryngitis, pharyngitis, hernia, etc.) were included in the study. For sampling, a list of patients was prepared. Then, based on sex distribution in age groups (0-2, 2-5, 10-5, and 10-15 years old), stratified random sampling was performed. If there is no evidence of inclusion criteria or finding of exclusion criteria, the nearest person in list had been included. One control was selected for every case and frequency matching was performed for two variables of age and gender. People who have a history of burns, their siblings have been selected as controls as well as vision problems, hearing impairment; learning difficulties, motor problems, and mental retardation were removed from the controls list.

### 2-2-3. Sample size

The required sample size was calculated in PS-Power and Sample Size Calculations version 3.1.2 (23), using "Family history of burn" as the main exposure, an odds ratio [OR] of 2.76 for having Family history of burn as shown by another study (11), assuming equal numbers of matched cases and controls, for 90% power and a two-sided significance level of 5%. The

sample was calculated as 198 cases and 198 controls.

### 2-3. Variables and measurements

The variables that were collected were: Weight (measurement was performed for all children using a digital scale), Height (measurement was performed for all children using a one devise), Body Mass Index (BMI) was calculated as weight in kilograms (kg) divided by the square of the height in meters squared ( $m^2$ ), hours that child haven't watchful, history of convulsion, birth order, household size, have more than one watchful, person who have most time with child, parental age, parental education, have single parent or two, parental smoking situation, housing status, mother job, father job, petroleum storage at home, heating devise, cooking energy type, tee maker tool, residence, household income, car worth and house size. Principal Component Analysis (PCA) was performed using three variables including: household income, car value, and house size. The first component was explained 67% of the variance. Based on the PCA test, the study subjects were divided into four groups (quartiles) in terms of socioeconomic status. The lower quartiles indicated poor economic status and higher quartiles indicate better socioeconomic status.

### 2-4. Ethical consideration

This study was approved by the Ethics Committee (IR.SBMU.PHNS.REC.1395.138) of Shahid Beheshti University of Medical Sciences. The data were collected by informed consent from parents.

### 2-5. Data Analyses

First, the odds ratio and 95% confidence interval for each of the independent variables were calculated using univariate logistic regression analysis. Then, the multivariate logistic regression analysis

was carried out using the Forward Stepwise (Likelihood Ratio test) method and variables which included in the univariate analysis with  $P < 0.2$ , were added in the model. In the multivariate analysis, the Collinearity assumption was evaluated that two variables of mother's age and household size had Variance Inflation Factor (VIF) equal to 2.9 and 2.37, respectively. By considering the correlation between them ( $r = 0.693$ ), they were kept in the model. All analyses were carried out using SPSS software version 21.0.

### 3- RESULTS

The mean age of cases and controls were  $4.29 \pm 3.51$  and  $4.30 \pm 3.45$  years, respectively, and the ratio of boys (58.7%) was higher than that of girls (**Table.1**) (*Please see the table in the end of paper*). The most common factor of burns was hot liquids with 48.5% (96 cases), followed by hot objects with 34.8% (69 cases). Oil (11 cases), gas (9 cases), gasoline (7 cases), and alcohol (6 cases) were in the next ranks. The frequency of burn was almost the same in different seasons, with the highest frequency in autumn (26.3%) and the lowest in summer (23.7%). About 30% of burns occurred between 17-20 o'clock (evening) and more than 25% at 10-12 o'clock (am). The percentage of burned body surface area (BSA) in most of the cases (58%) was between 15% and 35%.

Univariate analysis: The results of univariate analysis indicated that the body mass index (BMI) (OR = 1.283), birth order more than 3 (OR = 2.476), number of household members more than 5 (OR = 2.517), hours without watchful more than 2h (OR = 4.291), living with single parent (OR = 1.987), illiterate mother (OR = 5.913), illiterate (OR = 4.713) and low literacy father (OR=1.841), petroleum storage at home (OR=1.662), and the first (OR = 3.094) and second quartile (OR = 2.071) of socio-economic status

significantly increased the chance of burning in children (**Table.2**) (*Please see the table in the end of paper*). Multivariate analysis: The results of multivariate analysis indicated that BMI (OR=1.252), household members of 5 (OR = 2.540), 6 and more (OR = 8.472), lack of more than one watchful (OR = 2.481), hours without watchful 2h (OR = 1.997), 3 hours and more (OR = 8.649), illiterate mother (OR = 9.778), petroleum storage at home (OR = 1.815) and first (OR = 7.220) and second quartile (OR = 2.432) of socio-economic status significantly increased the chances of burning in children. Also, the increase in mother age (OR = 0.897) and the farmer (OR = 0.340) or worker father (OR = 0.233) reduced this chance.

### 4- DISCUSSION

The mean age of children with burns in this study was 4.3 years, which was roughly the same as the reports in this age range of burned children (24-27). The proportion of boys burned in this study was more than girls (58.7%). Except in reports by Mohammadi-Barzelighi et al. showed, that the burn rate in girls was slightly higher than that of boys in Tehran (28); in other studies, the results were almost the same as in the present study (24, 25, 29, 30). In a systematic review article of Hashemi et al. (2017), on the epidemiology of burns in Iranian children, it was mentioned that the most common cause of burns was hot liquids, and burn dispersion was similar in most seasons, as well as the average burn incidence in most studies were between 20- 30 percent (29). The results of this study are generally in agreement with those of other reports in other regions of Iran. Most of the burns occurred at hours close to dinnertime (17-20 h) or lunchtime (10-12 h), which could be due to the mother's engagement in providing dinner and lunch for the family, and consequently causing less attention to the child. The result of present study

showed that BMI, household size, haven't more watchful, more hours without watchful, illiterate mother, petroleum storage at home, weak socio-economic status, mother age and father job were the most related factor to burn in children. The BMI index in this study showed a positive and significant relationship (OR = 1.252), which means that by increasing BMI, the chance of burning was also increased. In those of the Wilmore and Pruitt (31), and in Barillo et al. (32), it was concluded that the risk of burns in obese boys was higher than that of normal people. The maternal age had a negative and significant relation with the incidence of burns in children (OR = 0.938). Therefore increasing the age of the mother, the chance of burns in the child was somewhat reduced. The above 4 birth order variables in the univariate analysis had a significant relation with burns (OR = 2.476), which was not observed in the adjusted analysis in the presence of other variables. There was a positive and significant relation with burns and Increase of family size. In those of Wrenech et al. (33), and Delgado et al. (34), it has been shown that the chance of burns was high in children who lived in crowd families. Haven't more than one watchful (OR = 2.481) and long hours without watchful (OR = 8.649) had a significant relation with burns.

Besides in the study by Delgado et al., it was shown that lack of alternate among parents increased the chance of burns. Illiteracy of the mother had a significant relationship with the child's burn injury (OR = 9.778), which was confirmed in similar studies (34-36). The children whose fathers jobs were likely to have more time with their families, such as farmers and workers, were less likely to be burnt than those fathers working in offices and markets. The socioeconomic variable indicated that children living in lower socioeconomic families had a higher chance of having a burn (OR = 7.22), and

this relationship was confirmed in other studies that low income of parents was a risk factor for increasing the risk of burns in children (34, 36). Few studies address the risk factors for burns in children. Since burns are a rare consequence, it seems that case-control study is the best option for doing such studies. The greatest weakness of (classics) case-control studies is the high probability of selection and information bias in them (37). In this study, we tried to reduce the bias by choosing the controls from children who were referred to the referral hospital for non-burning reasons. The information obtained from the control of the general population can lead to recall bias, but hospital controls are relatively more comparable to the cases because of greater collaboration (37) to response the questions. On the other hand, the controls of this study referred to the hospital because of various types of infectious diseases; there is a probability of underestimating the association of effect size of factors with parental care and socio-economic conditions.

## 5- CONCLUSIONS

Based on results of current study, it can be concluded that burning in Kermansh children is a multifactorial outcome, including individual, social, and environmental factors. In order to prevent them that need to plan the national and regional programs including all aspects of the individual, family, and environment. All of these factors can be prevented and if they are eliminated or reduced, it can be said that there will be a significant reduction in the number of burns in children.

**6- CONFLICT OF INTEREST:** None.

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**Table-1:** Unadjusted ORs for potential risk factors for pediatric burns in Iran by logistic regression.

Variables		Mean (standard deviation)		P-value	OR (95% CI)*
		Case	Control		
Age, year		4.29 (±3.51)	4.30 (±3.45)	0.977	Matched Variable
BMI, (kg/m <sup>2</sup> )		16.00 (±1.66)	15.27 (±1.84)	<0.001	1.283 (1.134 , 1.451)
Mother age, year		35.02 (±10.58)	33.64 (±7.84)	0.139	1.016 (0.955 , 1.038)
Father age, year		38.61 (±11.44)	37.47 (±8.93)	0.269	1.011 (0.992 , 1.031)
Variables		Frequency (percent)			
		Case	Control		
Gender	Boy	115 (58.1)	115 (58.1)		Matched Variable
	Girl	83 (41.9)	83 (41.9)	1	
Convulsion	No	179 (90.4)	182 (91.9)		1
	Yes	19 (9.6)	16 (8.1)	0.596	1.207 (0.602 , 2.422)
Birth order	1	47 (23.7)	57 (28.8)		1
	2	51 (25.8)	72 (36.4)	0.572	0.859 (0.507 , 1.455)
	3	51 (25.8)	45 (22.7)	0.263	1.374 (0.788 , 2.398)
	≥4	49 (24.7)	24 (12.1)	0.004	2.476 (1.329 , 4.615)
Household size	≤3	37 (18.7)	42 (21.2)		1
	4	53 (26.8)	77 (38.9)	0.391	0.781 (0.455 , 1.373)
	5	57 (28.8)	56 (28.3)	0.623	1.155 (0.650 , 2.054)
	≥6	51 (25.8)	23 (11.6)	0.006	2.517 (1.299 , 4.877)
Have more than one watchful	Yes	27 (13.6)	37 (18.7)		1
	No	171 (86.4)	161 (81.3)	0.174	1.455 (0.848 , 2.500)
The person with the most time with the child	Parents	176 (88.9)	183 (92.4)		1
	Others**	22 (11.1)	15 (7.6)	0.229	1.525 (0.766 , 3.035)
Hours without watchful	0	51 (25.8)	66 (33.3)		1
	1	36 (18.2)	58 (29.3)	0.438	0.803 (0.462 , 1.397)
	2	48 (24.2)	55 (27.8)	0.654	1.129 (0.663 , 1.923)
	≥3	63 (31.8)	19 (9.6)	<0.001	4.291 (2.286 , 8.055)
Mother education	Illiterate	34 (17.2)	7 (3.5)	<0.001	5.913 (2.213 , 15.800)
	Elementary and Guidance	93 (47.0)	77 (38.9)	0.230	1.470 (0.784 , 2.757)
	High school	48 (24.2)	86 (43.4)	0.247	0.679 (0.353 , 1.308)
	Academic	23 (11.6)	28 (14.1)		1
Single Parent	No	172 (86.9)	186 (93.9)		1



	Yes	26 (13.1)	14 (7.1)	0.049	1.987 (1.004 , 3.930)
Smoker mother	No	193 (97.5)	194 (98)		1
	Yes	5 (2.5)	4 (2)	0.736	1.256 (0.332 , 4.750)
Smoker father	No	129 (65.2)	126 (63.6)		1
	Yes	69 (34.8)	72 (36.4)	0.753	0.936 (0.620 , 1.413)
Father education	Illiterate	13 (6.6)	3 (1.5)	0.020	4.713 (1.277 , 17.397)
	Elementary and Guidance	44 (22.2)	26 (13.1)	0.048	1.841 (1.007 , 3.366)
	High school	84 (42.4)	107 (54.0)	0.500	0.854 (0.539 , 1.352)
	Academic	57 (28.8)	62 (31.3)		1
Mother job	Housewife	176 (88.9)	169 (85.4)		1
	Occupied	22 (11.1)	29 (14.6)	0.295	0.728 (0.403 , 1.318)
Father job	Employee	40 (20.2)	46 (23.2)		1
	Farmer and stockbreeder	47 (23.7)	55 (27.8)	0.953	0.983 (0.553 , 1.747)
	Driver	18 (9.1)	17 (8.6)	0.624	1.218 (0.554 , 2.674)
	Worker	64 (32.3)	49 (24.7)	0.157	1.502 (0.855 , 2.640)
Housing type	Market	29 (14.6)	31 (15.7)	0.828	1.076 (0.556 , 2.082)
	Personal	127 (64.1)	129 (65.2)		1
	Rental	71 (35.9)	69 (34.8)	0.833	1.045 (0.692 , 1.578)
Petroleum storage	No	85 (42.9)	110 (55.6)		1
	Yes	113 (57.1)	88 (44.4)	0.012	1.662 (1.117 , 2.472)
Heating device	Radiator	25 (12.6)	31 (15.7)		1
	Gas heater	120 (60.6)	122 (61.6)	0.505	1.220 (0.680 , 2.187)
	Oil Heater	53 (26.8)	45 (22.7)	0.261	1.460 (0.755 , 2.825)
Cooking energy	Gas	187 (94.4)	183 (9.4)		1
	Others <sup>†</sup>	11 (5.6)	15 (7.6)	0.419	0.718 (0.321 , 1.604)
Make tea by	Samavar	184 (92.9)	176 (88.9)		1
	Others <sup>‡</sup>	14 (7.1)	22 (11.1)	0.165	0.609 (0.302 , 1.227)
Socio-economic status	Quartile 1	66 (33.3)	32 (16.2)	<0.001	3.094 (1.729 , 5.535)
	Quartile 2	58 (29.3)	42 (21.2)	0.011	2.071 (1.179 , 3.640)
	Quartile 3	34 (17.2)	64 (32.3)	0.441	0.797 (0.447 , 1.419)
	Quartile 4	40 (20.2)	60 (30.3)		1
Residence	Urban	110 (55.6)	106 (53.5)		1
	Rural	88 (44.4)	92 (46.5)	0.686	0.922 (0.621 , 1.369)

\*OR= Odds Ratio, 95% CI= 95% Confidence Interval; \*\*. Sibling or babysitter; †. Electricity or petroleum; ‡. Stove, Electric kettle, Electric tea maker.

**Table-2:** Adjusted ORs for potential risk factors for pediatric burns in Iran by logistic regression.

Variables		P-value	OR (95% CI)*
BMI, (kg/m <sup>2</sup> )		0.004	1.252 (1.075 , 1.457)
Mother age, year		0.005	0.938 (0.897 , 0.981)
Household size	≤3		1
	4	0.740	1.128 (0.554 , 2.295)
	5	0.027	2.540 (1.111 , 5.807)
	≥6	<0.001	8.472 (2.630 , 27.285)
Have more than one watchful	Yes		1
	No	0.026	2.481 (1.116 , 5.517)
Hours without watchful	0		1
	1	0.831	0.929 (0.472 , 1.826)
	2	0.047	1.997 (1.008 , 3.958)
	≥3	<0.001	8.649 (3.682 , 20.318)
petroleum storage	No		1
	Yes	0.046	1.815 (1.084 , 3.348)
Mother education	Illiterate	0.002	9.778 (2.291 , 41.738)
	Elementary and Guidance	0.531	1.323 (0.551 , 3.180)
	High school	0.159	0.543 (0.232 , 1.270)
	Academic		1
Father job	Employee		1
	Farmer and stockbreeder	0.021	0.340 (0.136 , 0.847)
	Driver	0.096	0.367 (0.113 , 1.194)
	Worker	0.002	0.233 (0.092 , 0.590)
	Market	0.483	1.357 (0.578 , 3.184)
Socio-economic Status	Quartile 1	<0.001	7.220 (2.897 , 17.997)
	Quartile 2	0.015	2.432 (1.187 , 4.985)
	Quartile 3	0.202	0.631 (0.311 , 1.280)
	Quartile 4		1
Hosmer and Lemeshow test		Chi-square: 5.024 †df: 8	P-value: 0.755
Nagelkerke R square	0.405		

\*. OR= Odds Ratio, 95% CI= 95% Confidence Interval of OR; †. Degree of freedom.