Risk Factors of Caustic Agent Ingestion in Children: A Case–Control Study at Mofid Children's Hospital, Tehran

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BACKGROUND

- Caustic ingestion remains a significant paediatric health problem worldwide, leading to variable outcomes — from mild mucosal irritation to life-threatening oesophageal burns and long-term complications such as strictures.
- The global incidence is estimated at 5,000–15,000 cases per year, with children accounting for about 80 % of unintentional exposures.
- Although rates have decreased in high-income countries due to:
  - Regulatory control over production and packaging, and
  - Increased public awareness, it continues to be a major concern in developing regions, particularly among families with low socioeconomic status or limited education.
- Most incidents occur at home, involving unsupervised toddlers who accidentally ingest household cleaning products stored in non-standard or unlabeled containers.
- Preventive measures such as child-resistant packaging, safe storage, and education of caregivers are known to reduce these accidents.
- However, in Iran and similar contexts, national data are limited and there are no unified prevention protocols.
- This study therefore aimed to identify risk factors associated with caustic agent ingestion in children admitted to Mofid Children's Hospital, with the goal of guiding preventive strategies and public health policies.

METHODS

Study Design and Setting

- Case–control study conducted at Mofid Children's Hospital, Tehran (2016–2022).
- Approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.RAMREC.1394.186).
- Informed consent obtained from parents or guardians.

Participants

- Total sample: 123 children (<18 years).
  - Cases (n = 57): Children with caustic ingestion and oesophageal burns.
  - Controls (n = 68): Hospitalised children without oesophageal injury.
- Exclusion: Intentional ingestion (self-harm or suicide).

Data Collection

- Data gathered via structured parental interviews using a validated questionnaire.
- Collected variables included:
  - Demographics: age, sex, parental education, occupation, income.
  - Family background: domestic conflict, mental illness, addiction, smoking.
  - Exposure details: location, supervision, type of substance, storage method, safety caps.

Analysis

- Data analysed with SPSS v25 using Chi-square and t-tests.
- Results expressed as means, medians, and percentages.
- $p < 0.05$ considered statistically significant.

RESULTS

Participant Characteristics

- Total participants: 123 children (<18 yrs)
  - Cases: 57 (46.3 %)
  - Controls: 68 (53.7 %)
- Median age (cases): 29.5 months (IQR 20.8–48)
- Gender: 59.3 % boys vs 40.7 % girls
- Most incidents occurred between 1 – 5 years of age.
- No significant differences in parental age or occupation between groups.

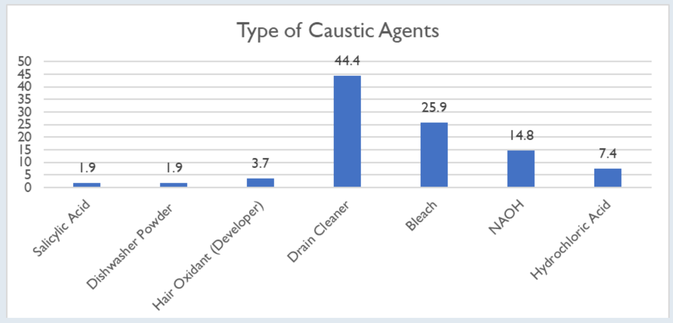

Figure 2: Types of caustic substances, ingested by children.

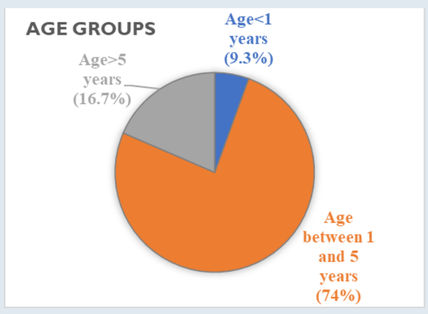

Figure 1. The patient distribution between age groups

		Case	Control	p-Value
		n (%)	n (%)	
sex	Female	22(40.7%)	28(41.2%)	0.961
	Male	32(59.3%)	40(58.8%)	
Mother's education	Diploma and under diploma	36(66.7%)	52(76.5%)	0.23
	Above the diploma	18(33.3%)	16(23.5%)	
Father's education	Diploma and under diploma	37(68.5%)	48(71.6%)	0.709
	Above the diploma	17(31.5%)	19(28.4%)	
Mother's occupation	House wife	48(88.9%)	61(89.6%)	0.885
	Employed	6(11.3%)	7(10.3%)	
Father's occupation	Governmental employee	15(27.8%)	16(23.9%)	0.699
	Manual worker	13(24.2%)	19(28.4%)	
	Self-employee	26(48.2%)	32(47.7%)	
family income	Below 10 M IRR	10(20.4%)	12(17.6%)	0.31
	1-3 M IRR	22(44.9%)	41(60.3%)	
	3-5 M IRR	13(26.5%)	13(19.1%)	
	Above 5 M IRR	4(8.2%)	2(2.9%)	

Table 1. demographic characteristics of case and control groups

DISCUSSION

- Caustic ingestion remains a preventable public health issue, especially in developing countries where safety regulations and parental awareness are limited.
- Most cases involved boys under 5 years, consistent with global data, reflecting developmental curiosity and lack of supervision.
- Low parental education and domestic conflict were more common among affected families, suggesting socioeconomic and psychosocial risk factors.
- Unsafe storage was widespread — nearly all agents lacked child-resistant caps (92.5%), and many were kept in drink bottles or unlabeled containers.
- Acidic agents (57%) were more frequent than alkaline, differing from trends in high-income countries.
- Although not statistically significant, higher rates of smoking, addiction, and mental illness were noted in case families.
- Overall, findings highlight the need for stricter packaging laws, public education, and parental supervision to prevent accidental ingestion.

		Case	Control	p-Value
Amount of consumption of the caustic substance per year	Never	3(5.9%)	2(2.9%)	0.315
	rarely	17(33.3%)	17(25%)	
	some times	14(27.5%)	15(22.1%)	
	Always	17(33.3%)	34(50%)	
Packaging method	Standardized and branded	39(83.3%)	51(76.1%)	0.377
	Non-standard and	8(17%)	16(23.9%)	
Season	Spring	21(44.7%)	-	
	Summer	9(19.1%)	-	
	Fall	5 (10.6%)	-	
	Winter	12(25.5%)	-	
Time of the accident	Day	40(78.4%)	-	
	Night	11(21.6%)	-	
Site	At the child's home	39(73.6%)	-	
	At a relative's home	9(17%)	-	
	Outside the home	5(9.4%)	-	
People present at the incidence	Parents	46(90.2%)	-	
	Others	2(3.9%)	-	
	Alone	3(5.9%)	-	
Container	Other's container	21(39.6%)	-	
	Original container	32(60.4%)	-	
Child-resistant safety cap	Present	4(7.5%)	-	
	Absent	49(92.5%)	-	
Consumption volume	Below 5 cc	16(29.6%)	-	
	5-15cc	23(42.6%)	-	
	More than 15 cc	4(7.5%)	-	
	Unclear	11(20.4%)	-	

Table 2: variable related to caustic substance ingestion of case and control groups

CONCLUSION

- Caustic ingestion predominantly affects boys under five years of age.
- Acidic substances were the leading cause of injury in this cohort.
- Major contributing factors included unsafe storage, absence of child-resistant caps, and low socioeconomic or educational background.
- Domestic conflict also showed a significant association with ingestion risk.
- Prevention should focus on:
  - Public education for caregivers
  - Strict regulation of packaging and labelling
  - Promotion of safe household storage practices
- Strengthening these preventive measures can significantly reduce the incidence and severity of this avoidable childhood injury.

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