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# Epidemiology of Pediatric Acute Poisoning in Southern Iran: A Hospital-Based Study

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## ABSTRACT

**Objective:** To determine the epidemiology of acute childhood poisoning in Shiraz, southern Iran.
**Methods:** This was a prospective cross-sectional descriptive study, being performed in Nemazee and Dastgheib Hospitals affiliated with Shiraz University of Medical Sciences. The study included pediatric patients (<18 years) referred to our centers due to acute poisoning. Demographic and etiological factors were prospectively recorded and analyzed.
**Results:** A total of 773 patients with mean age of 3.86 ± 1.5 years were recruited in the study. The most common group which included 352 (45.5%) patients, aged between 8 months and 5 years followed by 330 (42.6%) cases aged from 12-18 years. In majority of cases, poisoning was due to opium in 222 (23.5%) followed by analgesics in 181 (19.1%), which mostly included acetaminophen in 75(7.9%), anti-depressants in 170 (17.9%), anti-hypertensive drugs in 65 (6.8%) and hydrocarbons in 60 (6.3%). There were 260 (33.7%) boys and 513 (66.3%) girls. The poisoning occurred inadvertently in 387 (50.1%) cases while 298 (38.5%) patients committed suicide. Most cases (255 patients; 32.9%) were asymptomatic at presentation.
**Conclusion:** Our study substantiated the following findings: A) Alarmingly, opium is the most common cause of acute childhood poisoning in our area. B) Easy access to toxic material is the most common risk factor for acute childhood poisoning. C) Female predominance of acute childhood poisoning accompanied by high rate of suicidal attempts shows that psychiatric problems, especially depression is most common among young girls.

**Keywords:** Acute poisoning; Pediatrics; Epidemiology; Risk factors

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## Introduction

Acute poisoning is a common cause of morbidity and mortality among children accounting for more than 1 million cases annually reported to the Toxic Exposure Surveillance System (TESS) of the American Association of Poison Control Centers (AAPCC) [1,2]. Poisoning is also the third most common emergencies of pediatrics leading to high social and economic burden [1]. The high prevalence of acute poisoning in children is attributed to the curiosity of the children especially those aged less than 5 years to virtually taste or swallow harmful substances [2].

According to the children's propensity to eat everything, ingestion is the most common route of poisoning in children, accounting for approximately 77% of the cases. After ingestion, dermal, inhalation and ophthalmic involvements are considered to be the most common causes of poisoning in children with respective frequencies of about 7.5%, 6% and 5% [3]. As children are mostly kept at home, the pediatrics acute poisonings frequently (90%)

occur in the household and the substances causing poisoning are often domestic products including cosmetics, personal care items, cleaning solutions, plants, foreign bodies and hydrocarbons. Drugs and pharmaceuticals including analgesics, antimicrobial agents and vitamins are considered as the second most prevalent ingested poisons in children, often involving a single agent [4].

Although pediatric poisonings are considered emergencies, more than 85% of cases need no medical intervention because the ingested material is not toxic or the amount swallowed is not clinically significant [2,4]. During recent years the mortality due to acute poisoning in children has decreased dramatically because of establishing poison control centers in developed countries. In addition using child-resistant packing, early recognition of exposure and improved medical managements has led to decreased mortality arising from acute pediatrics poisonings [5]. However in developing countries including Iran, unawareness and inadequate public knowledge and the absence of poison control centers lead to higher mortality and morbidity rates.

Previous studies have shown that several factors are associated with acute poisonings in children including family size, socioeconomic condition, child attention and care and safe poison storage place [6,7]. The awareness about risk factors is of great help to prevent the acute poisonings. For instance, putting poisonous materials out of children's reach will decrease the acute child poisonings [4].

Epidemiological and etiological data of acute childhood poisonings are needed for healthcare providers to enable them to take appropriate measures for both prevention and treatment [2-4]. This information include age, sex, number of siblings, socioeconomic status, type of poisonous substance, educational level, presenting symptoms and the patients' outcome. Such data are scanty in our region. Thus present study aimed to determine the epidemiology of acute childhood poisoning during a 2-year period in Shiraz, southern Iran.

## Materials and Methods

### *Patients*

This is a prospective descriptive cross-sectional study, which was performed during a 20 months period starting from January 2009 to August 2010 in Nemazee and Dastgheib hospitals, both tertiary care centers affiliated with Shiraz University of Medical Sciences. All pediatric patients (<18 years) with acute poisoning presenting to the emergency units of these centers were included in the study. The study protocol was approved by the institutional review board (IRB) of Shiraz University of Medical Sciences and the approval of the Ethics Committee was acquired before initiating the study. Informed written consent had been obtained from all children's parents.

### *Study Protocol*

Information about detailed medical history, physical examination and demographic data including sex and age were obtained using a standard questionnaire. The age groups studied were 1-7 months, 8 months to 5 years, 6-11 years and 12-18 years. The type of toxic agent leading to poisoning was also recorded. The poisonous substances were further divided into 13 categories including opium, hydrocarbons (oil, gasoline, and gas), analgesics, anti-hypertensive drugs, anti-depressants, pesticides, antibiotics, detergents, anti-histamines, anti-convulsants, poisonous herbs, iron compounds, oral contraceptives and others. The type of poisoning was recorded as accidental, suicidal attempt, coercive, drug overdose and unknown. The reasons recorded for using poisonous substances were easy accessibility, personal problems, misuse of the prescribed medication which leads to drug overdose and others. The place of poisoning was also recorded. These occurred at home in the presence of parents, at home in the presence of a nurse, in houses of relatives, school or kindergarten, public places including parks, passages and shopping centers. The patients' symptoms and presenting conditions were also recorded as asymptomatic, decreased level of consciousness, lethargy and sleepiness, irritability with severe vomiting, cardiopulmonary arrest and others.

All patients received medical intervention and were admitted to the corresponding wards if needed. Nasogastric tube inserted for most individuals and activated charcoal was used for decontamination. All the patients were discharged from the hospital after becoming free of symptoms for 24-hours. Those who had committed suicide received a psychiatric interview and consult before discharging from the hospital. Mortality rate and cause of deaths were also recorded.

### *Statistical analysis*

The information was prospectively entered into a computer database. All statistical analyses were performed with the Statistical Package for Social Sciences version 17.0 (SPSS Inc., Chicago, IL, USA). Data were reported as means ± SD or proportions as appropriate. Analysis of the data was done using descriptive statistics like frequencies, proportions, group means, median and standard deviations.

## Results

Overall there were 773cases, aged from 21 days to 18 years, with mean age 3.86 ± 1.5 years and acute

**Table 1.** The sex distribution of 773 patients with acute poisoning in different age groups

| | Boys (n=260) | Girls (n=513) | *p*-value |
|---|---|---|---|
| 1–7 Months (%) | 21 (8.1%) | 14 (2.7%) | 0.084 |
| 5 Months – 8 Years (%) | 168 (64.7%) | 183 (35.7%) | <0.001 |
| 6–11 Years (%) | 24 (9.3%) | 32 (6.3%) | 0.125 |
| 12–18 Years (%) | 47 (17.9%) | 284 (55.3%) | <0.001 |

poisonings referring to our pediatric centers during the study period. The most common age group was 8 months to 5 years with 352 (45.5%) patients, followed by 12-18 years-old with 330 (42.6%) patients, 6-11 years-old with 56 (7.3%) patients and 1-7 months of age with 35 (4.6%) cases. There were 260 (33.7%) boys and 513 (66.3%) girls. There was a female predominance with a male to female ratio of 1:2 (Table 1).

As shown in Table 2, the most prevalent poison was opium, ingested by 222 (23.5%) patients followed by analgesics by 181 (19.1%) with acetaminophen 75 (7.9%), anti-depressants 170 (17.9%), anti-hypertensive drugs 65 (6.8%), hydrocarbons 60 (6.3%), alcohol (ethanol and methanol) 42 (4.4%), detergents 40 (4.2%), pesticides and insecticides 32 (3.3%), anti-convulsants 29 (3.06%), poisonous herbs 26 (2.7%), antibiotics 24 (2.5%), iron compounds 15 (1.5%), anti-histamines 13 (1.3%) and metoclorpramide by 10 (1.05%) patients. The ingested material could not be identified in 20(2.1%) cases. Multi-drug poisoning was recorded in 110 (14.2%) patients who committed suicide out of which 70 (9.1%) patients ingested combination of analgesics and anti-depressants and 20 (2.5%) patients ingested a combination of analgesics, anti-depressants and anti-hypertensives. We tried to indentify the factors that made patients susceptible to poisoning. The prevailing risk factor for acute poisoning was easy access to the toxic agent which was indentified in 387 (50.1%) subjects. Personal and family problems were the second most prominent risk factor especially for suicidal attempts which was identified in 298 (38.5%) patients. Entertainment and disregarding the side effects of opium and alcohol was found in 61 (7.9%) patients. Physicians' mistakes in prescribing drugs were responsible for acute poisoning in 10 (1.2%) cases and parental mistakes, in connection with drug dosages, were found in 17 (2.3%) patients. Out of 298 patients who committed suicide, 219 (28.3%) were girls and 79 (10.2%) boys. Most suicides occurred in summer by 195(25.2%) individuals followed by 45 (5.8%) in autumn, 28 (3.6%) in winter and 30 (3.9%) in the spring.

**Table 2.** The type of ingested toxic agents in 773 children with acute poisoning

| Ingested toxin | Percentage |
|---|---|
| Opium (%) | 191 (24.7%) |
| Analgesics (%) | 161 (20.8%) |
| Anti-depressants (%) | 142 (18.2%) |
| Anti-hypertensive (%) | 49 (6.3%) |
| Hydrocarbones (%) | 45 (5.8%) |
| Alcohol (%) | 32 (4.1%) |
| Detergents (%) | 29 (3.8%) |
| Pesticides (%) | 26 (3.4%) |
| Anti-convulsants (%) | 20 (2.7%) |
| Poisonous Herbs (%) | 18 (2.4%) |
| Antibiotics (%) | 16 (2.1%) |
| Iron compounds (%) | 11 (1.4%) |
| Anti-histamines (%) | 10 (1.3%) |
| Metoclorpramide (%) | 8 (1.1%) |
| Non-determined (%) | 15 (1.9%) |

Out of 773 patients who presented to our centers with acute poisoning, 500 (64.7%) were admitted to the pediatric emergency room and were discharged before 24 hours. However 203 (26.3%) patients were admitted to the wards and 45 (5.8%) were admitted to the pediatric intensive care unit (PICU). Only 25 (3.2%) patients were treated at outpatient. The deaths were recorded of 2 (0.25%) children during the study period. The first was a 5-year-old girl ingesting several tablets of methadone at home and in front of parents. She had taken the pills from the cupboard. She presented with diminishing level of consciousness and died due to aspiration. The second patient was a 10-year-old boy who had ingested organophosphate and presented with GI bleeding and respiratory distress. He was admitted to pediatric intensive care unit (PICU) but passed away the night after admission.

## Discussion

Acute poisoning is an important health concern in children associated with high morbidity and mortality [2,5]. This issue is much more prominent in developing countries including Iran, because of poor hygiene, limited access to the healthcare resources and inadequate knowledge about poison. This was a prospective cross-sectional hospital based epidemiological study which was carried out in two tertiary healthcare centers with referral from all areas of the southern Iran. Thus the study population is representative of inhabitants in the southern population of Iran. Up until now no study has been done on the pattern of acute poisoning

in children in southern Iran and to the best of our knowledge, this is the first study conducted in this area. Age, sex, toxic agents and other predisposing risk factors for accidental household poisoning are highlighted in this study.

Contrary to other reports worldwide, females predominated in our study with male to female ratio 1:2. Previous studies revealed male predominance with male to female ratio 1.09–1.8:1 [8,9]. Manzar *et al.*, [9] found a male to female ratio of 1.2:1, comparable to an Arabian study, which found a male-to-female ratio 1.2:1 for biological poisons and 1.5:1 for chemical compounds. There was a male predominance in the 1-7 months of age group. However females prevailed in all the other age groups. In the age group of 8 months-5 years the male to female ratio was approximately 1:1. However it decreased significantly by increasing the age from 5 years beyond [10]. Previous survey from Shiraz in 2005 (unpublished data) revealed a male predominance (male to female ratio 1.1:1) and with a 15.8% prevalence of suicide. The prevalence of suicide in our study was 38.5% which is increased significantly compared to previous data (unpublished).

The mean age of the patients in our study was 3.86 years which was compatible with previous studies [8-14]. Our study revealed that acute poisoning occurred mostly in children under 5 years of age. This is in agreement with other studies [8,9,13,14] and is most probably due to curiosity of children in this age group. Consistent with previous reports [15,16], the peak incidence of acute poisoning in our study was between 2-3 years. In our study 42.6% of the patients were between 12-18 years of age with 38.5% suicides, which is reflective of the high rate of acute poisoning due to suicidal attempts.

The most common ingested toxic agent in our series was opium, accounting for 23.5% of cases which is contrary to previous investigations studies [8-17]. Manzar *et al.*, [9] found that kerosene oil, medicines, insecticide and bathroom cleaners were the most prevalent toxic agents. This is compatible with Shakya *et al.*, [16] who found kerosene oil to be responsible for 53% of poisonings. Previous studies from other developing and Middle East countries revealed that oil and hydrocarbons are the most common toxic compounds [18-20]. The high rate of opium poisoning in our study demonstrates that this substance is highly available for consumption in our country. In most cases opium is ingested accidentally by children, which is indicative of easy access to this material. Some cases of opium poisoning were due to unawareness of the parents or relatives especially grandmothers, which gave the child opium to treat diarrhea. In other instances poisoning by opium is used by teenagers both for entertainment and addiction. These alarming rates of poisoning vindicate to impose strict limitation and distribution of these substances in the community.

Medications were the second most available agents responsible for acute poisoning. In this regard, analgesics such as acetaminophen, anti-depressants and anti-hypertensive drugs are accounted for frequent poisoning. This is compatible with studies from other parts of the world [9-13]. This shows that conventional drugs used by parents or household members serve as potential sources for acute poisoning of children. Unfortunately we could not record the place for storing drugs. However Manzar *et al.*, [9] found that cupboards and refrigerators were the usual places where drugs were kept. Abu-Ekteish showed that children were attracted by the colored medications especially those in red and pink colors [21]. Another important issue in our series is that anti-depressants are the second frequent medications causing acute poisoning in children. This shows the high rate of consumption of these drugs by household members. In addition the most common drug causing suicide was anti-depressants. In our series most of those who committed suicide were 12-18 years-old girls. This high prevalence of suicide found among teenage girls is a matter of concern, and highlights the high prevalence of psychiatric disorders especially depression among this group. Hydrocarbons and oil are next to medications. As mentioned above, previous studies from other developing countries found that hydrocarbons were the most common cause of acute poisoning in children. However, in our study hydrocarbons ranked fifth among ingested toxins. Alcohol (ethanol and methanol) ranked sixth as a cause of acute poisoning mostly in teenage boys. Alcohol consumption is prohibited in Iran both legally and socially. However it is accessible surreptitiously and it is usually impure and has several ingredients including methanol which is oculotoxic and causes severe irreversible toxicity of the optic nerve. This has dire consequences and usually leads to catastrophic outcomes including permanent blindness. Insecticides and poisonous herbs as well as detergents were less common and compatible with previous studies [8,12].

Unfortunately we could not exactly determine the quantity of the ingested toxins. Manzar *et al.*, [9] determined the quantity of ingested poison by taking careful history. They found that the amount of ingested toxin was minimal in approximately 60% of patients, and indicated that It is known that in most cases the amount of ingested toxin is minimal and is thus of no clinical value.

We found that most of our patients were asymptomatic at presentation. This demonstrated that in majority of cases, the amount of ingested toxic agents was minimal and not clinically significant. Decreased level of consciousness was the most prevalent clinical presentation. This is predominantly due to the ingestion of opium which causes lethargy, respiratory depression, decreased level of consciousness and respiratory arrest. Manzar *et al.*, [9] divided the presenting conditions according to the toxic agent. They found that dyspnea and vomiting were prevailing symptom in kerosene poisoning whereas the symptoms were different in those poisoned by medications. The presenting symptoms depend on the type of ingested drug. The studies from India and Turkey report similar findings [22,23]. They also found that those who ingested detergents were mostly symptomatic.

It is known that acute poisoning in both adults and children is often associated with morbidity rather than mortality. The mortality rate in our series was 0.25% (2 cases) that resulted from ingesting either organophosphate or methadone. The mortality rate in studies from India is reported to be as high as 11.6% while it ranged from 2.5% to13.6% in studies from Pakistan [17,24]. Several factors have been implicated as risk factors for mortality in those with acute poisoning including education of mother, their knowledge about poison, storage place of poison along with the numbers of siblings and family members. Multifactorial studies found that younger age of mother with education level below high school makes the children susceptible to acute poisoning and its consequences [25,26]. Other studies have demonstrated that children with more than 2 siblings become neglected and had a greater chance of exposure to injuries. In this regards, Manzar *et al.* found that 45% of the patients had more than 3 siblings [9].

There are some limitations in our study, including its being descriptive with limited information. We could not determine the amount of ingested substance, and the therapeutic procedures employed for each individual. Preferably multicenter studies are needed to clarify the pattern of acute childhood poisoning in southern Iran. Additionally, we were unable to record all risk factors that made the patients susceptible to poisoning, including the place for keeping the toxic agents, the number of siblings, and parent's profession. Future studies should clarify the role of various factors involved in childhood poisoning, in order to improve the quality of this type of research. Nonetheless, this study provides valuable information about the demographic characteristics and common toxic materials which cause childhood poisoning in southern Iran.

Our study revealed that: A) Opium poisoning remains an alarming finding regarding acute childhood poisoning. Governmental organizations should take prompt action to combat the distribution and consumption of these substances. B) Easy access to toxic materials is the major risk factor for acute childhood poisoning, which demands increasing public awareness. Mass media and newspapers should provide practical information to tackle, reduce eliminate this important threatening problem.) Because of frequent poisoning with medications, the pharmaceutical companies should use child-proof packages for their products to prevent children' access to such items. D) Female predominance of acute childhood poisoning accompanied by high rate of suicidal attempts shows that psychiatric problem especially depression is very common among young girls in our region. Thus increasing public knowledge and psychological consultations are strictly recommended for preventing these catastrophic events.

**Conflict of Interest:** None declared.

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