

# Risk factors of acute poisoning among children: A study at a poisoning unit of a university hospital in Egypt

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## Abstract

Childhood poisoning is a major cause of morbidity in both developing and developed countries. In spite of the success of some interventions to prevent accidental poisoning in the pediatric population, toxic ingestions continue to be a common occurrence. This aim of this study was to identify the incidence rate and determinants of acute poisoning among children (1-60 months old) who were admitted to the Poisoning Unit of a university hospital in Egypt. A study was conducted in the period from July 2011 until May 2012 at the poisoning unit of a university hospital. The studied children were from both rural and urban areas, were a mix of boys and girls, did not suffer from any mental disabilities, were aged between 1 month old to 60 months old, and were of Egyptian nationality. Data was collected by using a clinical examination form and a questionnaire. All parents/carers of the studied children were interviewed as well. Clinical assessment of the children included: general health conditions; AVPU (alert, respond to verbal stimuli, respond to painful stimuli, unconsciousness); and clinical examinations. The findings of the study demonstrated that 18.5% of total admissions were children (1-60 months old), 62.5% were males, 83.3% did not attend nursery, 79.9% were from urban areas, 33% of mothers were illiterate, and 60.2% of poisonings were due to household products. Kerosene alone was implicated in 24.3% of all cases; 37.4% of cases took place in the kitchen; 47.4% of cases were poisoned during the period between 8am and 4pm, and 65.4% reached the poisoning unit within 2 to 4 hours of accidental poisoning. Risk factors among the studied children were ordered by stepwise regression analysis as the following: non employed mothers; children who did not attend nursery; children of the male gender; and the education and literacy level of their mothers. Effective health promotion programs for parents and carers regarding poisoning hazards are needed to increase awareness and reduce the incidence of poisoning among children.

**Keywords:** Poisoning, Children, Incidence, Risk factors, Egypt.

## Introduction

Poisoning can be defined as taking, or being otherwise exposed to, a substance or substances which are injurious to a person's health.<sup>1</sup> Childhood poisoning is a major cause of morbidity in both the developing and the developed world. In spite of the success of some intervention strategies to prevent accidental poisoning in the pediatric population, toxic ingestions continue to be a common occurrence.<sup>2</sup>

The pattern of incidence and the risk factors for children's acute poisoning change with time and differ from country to country, and even between geographical areas within the same country.<sup>3</sup> An American survey revealed that, of the different external causes of unintentional injury and death among children aged between 1 and 14 years, poisonings ranked fourth, after road traffic crashes, fires and drowning.<sup>4</sup> The Japan Poison Information Centre (JPIC) received 31,510 enquiries in 1995 about poisoning in children under 6 years of age; the inquiries related to children less than 1 year old were 35.7% of the cases.<sup>5</sup> Data from the American Association of Poison Control Centers (2009) showed that children less than 6 years old made up 50.9% of cases and 2.4% of the total reported fatalities, and the most common causes of poisoning among children were due to pharmaceutical prod-

## Practice Points

- Childhood poisoning is a major cause of morbidity in both developing and developed countries.
- The incidence rate of acute poisoning among children (1-60 months old) was 18.5% with a male predominance of 62.5%.
- Kerosene alone was implicated in 24.3% of all cases; 37.4% of cases took place in the kitchen; 47.4% of cases were poisoned during the period between 8am and 4pm, and 65.4% reached the poisoning unit within 2-4 hours of poisoning.
- Risk factors in children were non employed mothers; children who did not attend nursery; children of the male gender; and the education and literacy level of their mothers.
- Effective health promotional programs for parents and carers regarding poisoning hazards are needed to increase the awareness and reduce the incidence of poisoning among children.

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ucts.<sup>6</sup> An estimated 86,000 childhood poisoning incidents were treated in US hospital emergency departments in 2008, amounting to 429.4 poisonings per 100,000 children.<sup>7</sup> Various studies have identified kerosene, petrol, medicines, insecticides, and household cleaning products as major hazards for poisoning incidents among young children.<sup>3,8</sup>

Poisoning can have long-term psychological and physical consequences for children, and may result in large societal costs. In low- and middle-income countries, poisoning accounts for 10% of the total burden of unintentional injuries, and 6% of disability adjusted life years.<sup>9</sup> Unfortunately, much of the country-specific information is from high-income countries. Some low- and middle-income countries have established poison control centers and begun to conduct research on poisonings.<sup>6</sup> Although there are educational programs and public campaigns designed to prevent children's acute poisoning, it continues to be a common medical emergency in the pediatric population.<sup>4</sup> Despite advances such as childproof caps on medication bottles, childproof packaging, increased educational efforts, and increased awareness of commonly ingested substances, deaths due to unintentional poisonings still occur.<sup>7</sup> This study will try to identify the incidence rate and determinants of acute poisoning among children (1-60 months old) who were admitted to the Poisoning Unit of a university hospital in Egypt.

## Materials and methods

### *Research setting*

The present study was conducted in a Poisoning Unit at a University Hospital in Egypt. This unit of poisoning is the main centre in the governorate, where any poisoning case that needs consultation is referred to.

### *Study design*

A study was conducted in the period from July 2011 until May, 2012. This study was conducted in three phases. Phase 1: three months preparatory phase (during which site of the study, target population, preparation of interview sheet, pilot study, sampling and ethical consideration were done); phase 2: three months implementation phase (during which data collection, diagnosis, treatment, and follow up till reaching the outcome of the case) were conducted; and Phase 3: five months evaluation phase (during which data entry, statistical analysis, results, discussion, conclusion and recommendations were formulated).

### *Target population and Sampling*

All children from both rural and urban areas who were admitted to the examined poisoning unit during the implementation phase of the present study (3 months) were included in the present study. Others inclusion criteria were: boys and girls, not suffering from any mental disabilities, aged between 1 month old and 60

months old, and of Egyptian nationality.

### *Data Collection*

Data was collected by using an examination form (containing personal history, complaint, present history, past history, family history, general examination, local examination, investigations, and final diagnosis) and a questionnaire (demographic data, causes of poisoning, risk factors of poisoning, route and type of poisoning). All parents/carers of the studied children were interviewed.

Clinical assessment of the children included: general health conditions; AVPU (alert, response to verbal stimuli, response to painful stimuli, unconsciousness); and clinical examinations (temperature, pulse rates, blood pressure, mouth ulcers/corrosions/cyanosis, skin color changes, pupil dilation, respiratory rates, signs of respiratory distress and CNS manifestations).

Regular evaluation of the patient suspected of an overdose was essential for identifying new or developing findings or toxic syndromes, and for early identification and treatment of a deteriorating condition. This was done until the patient recovered completely, or was considered to no longer be at risk of the consequences of a toxic exposure. Estimation of vital signs was recorded every 4 hours. The following tests were done to confirm the diagnosis or initiate treatments: ECG for cases with digitalis intoxication; chest radiographs for all cases involving corrosive poisons, as well as kerosene and other related petroleum distillates; ultrasound and/or CT scans for selected cases; arterial blood gases routinely for all cases involving household products, drugs and narcotic related acute poisoning; urea, creatinine, transaminases, PT, PTT, INR, CBC and serum electrolytes for all cases admitted to the ICU; random blood glucose tests for cases poisoned with overdoses of ingested oral hypoglycemic drugs, as well as all ICU patients; serum tegretol level for tegretol toxicity; serum digoxin concentration for digitalis toxicity; serum theophylline level for theophylline toxicity; and viva color test for the cases of accidental ingestion of unknown drugs.

### *Statistical analysis*

Data entry and statistical analysis were done by using the Epi Info program (3.2.2 version, CDC, USA). Proportion, mean±SD, and stepwise regression analysis were the statistical methods used in analysis of obtained data.

### *Ethical consideration*

All administrative approvals were taken from the administrative team of the hospital including the managing director and the head of the departments. All parents/carers of the examined children were subjected to a brief description on the aim of the study and oral consent was taken from them before the inclusion of their children into the present study.

## Results

During the study period, 18.5% (n=437) of the total admitted cases (n=2358) in the Poisoning Unit were children aged 1-60 months (Mean±Std: 29.5±12.2). Among 437 children, 273 (62.5 %) cases were males and 349 (79.9%) children were from urban areas. The age range of mothers and fathers was 17-44 years (mean±Std: 28.03 ±4.4) and 19-53 years (mean±Std: 34.4±6.2) respectively. The working hours of mothers and fathers was 6-8 hours/day (mean±Std: 6.08±0.4) and 6-12 hours/day (mean±Std: 7.2±2.05) respectively. The number of members in the family is between 3 to 10 (mean±Std: 5.04±2.2). The other socio-demographic characteristics of the studied children and their parents are shown Table 1.

Table 2 shows routes of poisoning; 99.3% of the poisonings occurred via oral routes. Household products were shown to be the leading causative agents (60.2%) for acute poisoning in the present study – kerosene alone was implicated in 106 (24.3%) cases. Cleaning products (chlorine, detergents) were the next common household products – 64 (14.6%) cases were due to

**Table 1:** Socio-demographic characteristics of the studied children and their parents

Characteristics	Respondents (%) (n=437)
<i>Child Gender</i>	
Male	273 (62.5%)
Female	164 (37.5%)
<i>Child Residency</i>	
Rural	88 (20.1%)
Urban	349 (79.9%)
<i>Child education</i>	
Attending nursery	73 (16.7%)
<i>Employment status - mothers</i>	
Working	46 (10.5%)
<i>Educational level - mothers</i>	
Illiterate	90 (20.6%)
Read and write	54 (12.4%)
Primary school	39 (8.9%)
Prep school	36 (8.2%)
Secondary school	137 (31.4%)
University	81 (18.5%)
<i>Employment status - fathers</i>	
Working	420 (96.1%)
<i>Educational level - fathers</i>	
Illiterate	61(14%)
Read and write	75 (17.2%)
Primary school	20 (4.6%)
Prep school	35 (8%)
Secondary school	152 (34.7%)
University	94 (21.5%)
<i>Carer during accident</i>	
Mother	386 (88.3%)
Others	51 (11.7%)
<i>Family type</i>	
Simple	381 (87.2%)
Compound	56 (12.8%)

**Table 2:** Route and type of poisons among the studied children

Route and types	Respondents (%) (n=437)
<b>Route of exposure to poison</b>	
Oral	434 (99.3%)
Dermal	2 (0.5%)
Respiratory	1 (0.2%)
<b>Type of poisoning</b>	
<i>Household product</i>	263 (60.2%)
Kerosene	106 (24.3%)
Cleaning products	74 (16.9%)
Chlorine	64 (14.6%)
Others	10 (2.3%)
Pesticides	59 (13.5%)
- Insecticides	52 (11.9%)
- Others	7 (1.6%)
Caustic potash	9 (2.1%)
Disinfectants	8 (1.8%)
Others	7 (1.6%)
<i>Drugs</i>	102 (23.3)
Antiepileptic/Anticonvulsant	15 (3.4%)
Analgesics	12 (2.7%)
Oral contraceptive pills	10 (2.3%)
Cough medication	6 (1.4%)
Antihypertensive tablets	7 (1.6%)
Digoxin tablets	5 (1.1%)
Unknown drug	5 (1.1%)
Others (different medicines)	42 (9.6%)
<i>Food poisoning</i>	55 (12.6%)
<i>Others</i> (Unknown substance, snake bite, mercury, castor seed etc.)	17 (3.9%)

chlorine. Drugs were responsible for 102 (23.3%) cases; the most common drug was found to be anticonvulsants, ingested by 15 (3.4%) children. Pesticides accounted for 59 (13.5%) cases, and food poisoning was implicated in 55 (12.6%) cases.

Table 3 shows that 47.4% of cases were poisoned during the period of time between 8 am and 4 pm and 163 (37.3%) cases were poisoned between 4 pm and 12 am. About 65% of cases reached the poisoning unit within 2 to 4 hours of accidental poisoning, while 24% of cases reached there within 4 to 6 hours. Approximately 90% of cases were poisoned in their parent's house, with 37% of accidents taking place in the kitchen. It was shown that 317 (72.5%) cases of poisoned children were affected from reachable sources (at a height of 150 centimeters from floor); in 198 (57.2%) cases containers were locked, but in 197 (45.1%) cases, it was revealed that the poison was not in its original container.

Table 4 shows details clinical findings of the children; 54.6% cases were ill and 363 (83.1%) cases were alert with regards to their AVPU score.

**Table 3:** Time, place, location, availability and container of poisons among the studied children

Time, place, location, availability and container of poison	Respondents (%) (n-437)
<i>Time of exposure</i>	
8am - 4pm	207 (47.4%)
4pm - 12am	163 (37.3%)
12am - 8am	67 (15.3%)
<i>Time of consultation</i>	
Less than 2 hours	14 (3.2%)
2 – 4 hours	286 (65.5%)
4 – 6 hours	105 (24%)
More than 6 hours	32 (7.3%)
<i>Place of poisoning</i>	
Parent's house	390 (89.2%)
Grandparent's house	16 (3.7%)
Others	31 (7.1%)
<i>Location of poisoning</i> (cases other than food poisoning; n-382)	
Kitchen	143 (37.4%)
Bedroom	91 (23.8%)
Bathroom	67 (17.5%)
Garden	3 (0.8%)
Others*	78 (20.4%)
<i>Reach ability of poison</i>	
Reachable (150cm from floor)	317 (72.5%)
Not reachable (>50cm from floor)	50 (11.4%)
<i>Others</i>	70 (16.01%)
<i>Type of containers</i>	
No container	91 (20.8%)
Original	149 (34.1%)
Not original	197 (45.1%)
<i>Status of observed containers</i> (n-346)	
Locked	198 (57.2%)
Unlocked	148 (42.8%)

\*Living room, dining room, balcony & unknown place.

As per treatment modalities, gastric lavage was done for 164 (37.5%) cases, IV fluids were given to 152 (34.8%) cases, and 127 (29.1%) cases did not take any medicines; 125 (28.6%) cases were given H<sub>2</sub> blockers and corticosteroids, whereas 35 (8%) cases were given H<sub>2</sub> blockers, antiemetics, antispasmodics, and metronidazole.

More than 67% of cases were discharged from hospital within 6 hours, while 116 (26.5%) cases were discharged within 6 to 12 hours. 27 (6.2%) cases were discharged after 12 hours. The majority of cases (97%) recovered, while 13 (3%) cases were referred to the ICU, where they remained until their recovery. No children died during the study period.

The stepwise regression analysis in Table 5 shows the order of the risk factors of acute poisoning among the studied children: children of mothers who were not

**Table 4:** Clinical examinations of the studied children

Clinical Examinations	Respondents (%) (n-437)
<i>General condition</i>	
Healthy	104 (23.8%)
Ill	239 (54.6%)
Distressed	20 (4.6%)
Drowsy	63 (14.4%)
Comatose	11 (2.6%)
<i>AVPU</i>	
A:Alert	363 (83.1%)
V:Respond to verbal stimuli	50 (11.4%)
P:Respond to painful stimuli	13 (3%)
U:Unconscious	11 (2.5%)
<i>Respiratory rate</i>	
Normal	414 (94.7%)
Tachypnea	22 (5.1%)
Bradypnea (respiratory rate <20)	1 (0.2%)
<i>Pulse</i>	
Normal	437 (100%)
Abnormal	0
<i>Temperature</i>	
Normal	416 (95.2%)
Fever(>37.5)	21 (4.8%)
<i>Blood pressure</i>	
Normal	432 (98.9%)
Hypotension	5 (1.1%)
<i>Mouth</i>	
Ulcers and corrosions	11 (2.5%)
Nothing	381 (87.2%)
Redness around mouth	45 (10.3%)
<i>Skin</i>	
Free	434 (99.3%)
Red	2 (0.5%)
Cyanosis	1 (0.2%)
<i>Pupil</i>	
Reactive	433 (99.1%)
Pin point pupil	4 (0.9%)
<i>Signs of respiratory distress</i>	
Yes	20 (4.6%)
No	417 (95.4%)
<i>Central nervous system</i>	
Free	432 (98.8%)
Convulsions	3 (0.7%)
Hallucinations	2 (0.5%)

employed (housewives), children who were not attending nursery, children of the male gender, and, lastly, the education and literacy level of the mothers.

## Discussion

Acute poisoning is one of the most prominent causes of emergency unit admissions. Identification and documentation of epidemiological aspects and other variables in childhood poisoning are of great importance for the determination of proper preventive measures. In the present study, acute poisoning accounted for 18.5% of the cases admitted to the examined toxicology unit. Studies conducted by Andiran & Sarikayalar<sup>12</sup> in Turkey found that, out of 489 poisoning cases, the majority

**Table 5:** Stepwise regression analysis of risk factors of acute poisoning among the studied children

Risk factors	B-Coefficient	Partial F test
Not employed mothers (housewives)	-0.0053	2.9
Children not attending nursery	-0.0094	1.8
Male gender	-0.0032	1.5
Illiterate and only read and write mothers	-0.0015	1.2

of the victims under 10 years of age were male, whereas most of the victims over 10 years of age were female. In several studies, it has been reported that 51.4%-73.3% of all poisoning cases observed in Turkey involved children <5 years of age.<sup>10-13</sup>

It was observed that in developed countries, the percentage of pediatric emergency service admissions for poisoning was between 0.28% and 0.66%.<sup>8-15</sup> According to these findings, it is postulated that poisonings are still an important issue in Egypt (very low proportion in developed countries when compared to the proportion of the present study). The male predominance (62.5 %) of poisoning in this study was also supported by studies conducted in Pakistan<sup>1</sup> and in Kuwait.<sup>14</sup> This could be explained as males are more active than females, less obedient to their parents orders, and are more likely to explore world around them.

Ozdogan *et al.*<sup>13</sup> found that the highest incidences of poisoning occurred in children in the age group of 13 months to 4 years. In this age group, putting small foreign objects like drugs into mouth by children can cause poisoning. In the present study, 99.3% of the studied cases were poisoned through oral routes and 23.3% of all poisonings were due to drugs. This may be due to placing the drug in easily accessible places.

It was also found in the present study that 24.3% of the studied cases were poisoned by kerosene. Kerosene oil is the most common hazardous substance ingested accidentally by children living in developing countries like Pakistan,<sup>1</sup> India,<sup>16</sup> and Sri Lanka,<sup>17</sup> most likely due to their inquisitive behavior. Surprisingly, in this era of social and technological development, kerosene poisoning cases are still reported from industrialized countries.<sup>3</sup> The toxic effects on the body are a result of its chemical properties: it is more aromatic, has a lower viscosity, as well as a lower surface tension. It was reported in an Iraqi study<sup>18</sup> that, for children below 5 years, the most prominent causes of death through poisoning were hydrocarbons, again mainly kerosene (56.2%), followed by drugs, then insecticides, household products, carbon monoxide, and rat poison. Other studies in Kuwait,<sup>14,19</sup> Pakistan,<sup>20</sup> Austria,<sup>21</sup> and India<sup>22</sup> have also implicated kerosene as a major cause of acute poisoning among children below 5 years old. However, studies conducted in the United Arab Emirates,<sup>23</sup> Oman,<sup>24</sup> Turkey,<sup>12</sup> and Greece<sup>25</sup> found drugs to be the

major cause of poisoning in children. This could be referred to changes in habits and lifestyles, beside improvements in the socioeconomic state. Also, the type of drug reflects the common drugs used in each community.

In the present study, it was noted that the urban environment is more hazardous, and this could be explained by the increased availability and use of poisonous substances over rural areas. It was also found that the mean number of capita per the studied families was 5.04 which is consistent with the findings of Azizi *et al.*<sup>26</sup> and Ozdogan *et al.*<sup>13</sup> from Turkey.

It was reported in the present study that mean age of the mothers of the affected children was 28.03 years. This corresponds to the findings of a study conducted in Iraq<sup>18</sup> which found that most accidental poisoning cases occurred in children with mothers aged 25-35 years. In the present study, the children of working mothers were at a lower risk of poisoning than those of housewives. This finding is in line with Chatantiprapa *et al.*<sup>27</sup> from Thailand and from Burkina Faso.<sup>28</sup> Housewife mothers provide inadequate supervision to their children and can inadvertently create a hazardous home environment due to unhealthy storage habits.<sup>25</sup> Contrary to that, working mothers often leave their children in a selected environment (such as a nursery) with chosen supervisors. This was evident in the present study as the majority of the poisoned children did not attend a nursery. These findings confirm the significance of adequate and appropriate supervision, as well as a safe environment as a way to reduce the risks of exposing children to poisonous substances. Also, the amount of time the mothers spent with their children was not found to be as important as what a mother brings to the relationship with the child. On average, these employed mothers are working for about 6 hours per day, but it could be postulated that they spend more time with their children on days off, and less time on household chores, leisure and other activities, thus helping keep children away from poisons.

In the present study, the highest frequency of cases of poisoning was noticed at between 8 am and 4 pm followed by the period between 4pm and 12am (Table 3). This confirms that the working status of the mothers is not a direct cause of the accidents of poisoning among the studied children, as a majority of the accidents occurred during a time that employed mothers would be at work, but unemployed mothers would still be at home (with the present study revealing that 89.5% of the admitted cases were children of unemployed mothers). This agrees with a study conducted in Iraq<sup>18</sup> which found that the highest frequency of poisoning cases was noticed at between 8am and 12pm followed by the times between 12pm and 4pm.

It was found in the present study that the majority of cases who were admitted to the poisoning unit were alert with normal signs and very few symptoms of poisoning (e.g. normal respiratory rate, pulse rate, tempera-

ture, blood pressure etc.). It was also demonstrated that the most of the toddlers were usually presented for evaluation within 2-4 hours, with 97% of cases were recovering, and no fatalities occurring during the period of the study. This could be attributed to the fact that acute poisoning among the studied children was unintentional (not suicidal) and the amount taken by the children usually small.

## Conclusion

The incidence rate of acute poisoning among children (1-60 months old) was 18.5% with a male predominance of 62.5%. Kerosene alone was implicated in 24.3% of all cases and 37.4% of cases took place in the kitchen. No fatalities were reported. Risk factors among the studied children were ordered by stepwise regression analysis and identified children of unemployed mothers (housewives), children who did not attend nursery, children of the male gender, and the educational level of mothers. Effective health promotional programs for parents and carers regarding poisoning hazards are needed to increase the awareness and reduce the incidence of poisoning among children.

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