



Acute Pharmaceutical Poisoning among Children in Baghdad, Iraq: A Prospective Hospital-Based Study

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Abstract

Background: Although the impact of acute pharmaceutical poisoning on pediatric emergency admissions is a major public health problem around the world, the burden of acute pharmaceutical poisoning in Baghdad and the patterns of drug storage and parental education and understanding remains poorly understood.

Objectives: To describe the demographic, socioeconomic and household factors associated with acute pharmaceutical poisoning among children under 12 years of age admitted to a tertiary Emergency Department in Baghdad and to determine the frequency of the poisoning.

Method: A prospective descriptive study was conducted for 6 months (1 March – 1 September 2016) in a children's teaching hospital in Baghdad. Children under 12 years who were admitted with accidental pharmaceutical poisoning were all included. Age, gender, storage place and accessibility, parental education, place of residence, drug type and formulation, clinical presentation, time to presentation, management and outcome related informations were captured and analyzed using the chi-square test (SPSS v23) with a p value of < 0.05 and is regarded as significant.

Results: 68 (60.71%) were males and 44 (39.29%) females out of 112 children, ($p < 0.05$). Most resided in urban areas (84.82% vs 15.17% rural, $p < 0.05$). Drugs were stored within a child's reach (<150 cm) in 78.58% of cases, most often in the bedroom (56.25%) or kitchen (30.35%) ($p < 0.05$). The highest proportion of cases was associated with maternal illiteracy (47.32%) and paternal education level showed no consistent association.

Conclusions: The analgesics were the most commonly reported drug class for acute drug poisoning, while the illiterate mothers, the urban dwellers and the boys were more prone to acute drug poisoning. Children presented 1-5 hours post ingestion were asymptomatic and only treated with observation, and no death was reported.

1. Introduction:

Poisoning: It is an act or exposure to a substance or substances that result in symptoms and signs of organ dysfunction that cause injury and/or death [1,2].

Toxicology: It is a branch of medicine that deals with the origin, disposition, effects, toxic levels and treatments for poisons [3].

Poison: Any substance that, when introduced into or absorbed by a living thing, causes injuries or kills that individual, or can injure or impair function in the body by chemical actions [1]; a chemical agent that causes dysfunction or injury in the body [2].

Toxidrome: It is defined as a group of signs and symptoms resembling those caused by a particular toxin or chemical agent [3].

Classification of Poisoning

There are several categories of poisoning as follows:

1. **Accidental poisoning** – most common, usually in children less than 5 years of age, who are the age at which children are most likely to put things in their mouths.
2. **Intentional poisoning** (child abuse) – should be suspected, especially in children under 5 years of age, and even in adolescents, in the case of suicide attempts.
3. **Iatrogenic poisoning** – from drug overdose (usually digoxin, theophylline and anticonvulsants) and supplement overdose, such as vitamin D toxicity, is also increasingly recognised [4].
4. Drug abuse (among adolescents including alcohol, psychostimulants, anti-depressants and hallucinogens). There are other ways to classify according to the route of ingestion or the mode of action of the poison.

Epidemiology

Acute poisoning is a common cause of hospital admission worldwide [5] and represents a major cause of morbidity in both developing and developed countries. Toxic ingestion is a common event [6] although some intervention policies do exist to prevent accidental poisoning in children. In the U.S., poisoning has become the top cause of unintentional injury-related death, outnumbering motor vehicle collisions, and most are the result of unintentional poisonings and not suicide [7].

The number of children reported as poisoned has been reported to range from 0.33% to 7.6% [8], depending on the study, and is dependent on the time period, country, and even geographic region [9] within countries. The individuals that are at the highest risk of poisoning, accounting for about 80% of all poisoning cases, are children aged 1-5 years [10] and male children are more often affected by poisoning than female children [11,12].

According to the American Association of Poison Control Centers report of 2001, 1.2 million poisoning events occurred among children under 6 years of age [13]; based on this, it is estimated that 86,000 pediatric poisoning events took place in 2008 in United States emergency departments, resulting in 429.4/100,000 children being treated for poisoning. Although better packaging materials, child-resistant packaging and increased public education have helped prevent unintentional poisoning, unintentional poisoning death still occurs [14]. It is estimated that poisoning is the cause of 3-5% of all mortality; medications given by parents are the main cause of poisoning in the first year of life while household

cleaning products are the predominant cause at 2-3 years of age. Unsecured medications are the main cause at 3-5 years [15].

The in-hospital mortality rate for a poisoning event is now 1–2% [16]. A significant decrease has been seen in the mortality rate from unintentional poisoning over the last 50 years (ranging from about 500 deaths a year in the 1940s to 25 a year in 1997). The decrease has been attributed to child-resistant closures, safer product reformulations, anticipatory guidance, public education, legislation, new poison control centers, better product and treatment databases, better medical treatment, newer antidotes, and changing to less hazardous pharmaceuticals instead of more toxic ones (e.g., acetaminophen instead of aspirin, benzodiazepines instead of older sedative-hypnotics) [17].

Children are more vulnerable to poisoning than adults and contributing factors include curiosity, not being able to read warning signs, imitating adult behavior, and failure to supervise children, while other studies have suggested that family stress and certain behavioral characteristics of the child may also be involved [18,11]. Iraqi children have also been shown to face broader chemical exposure risks in their everyday environment, beyond pharmaceutical agents, for example exposure to pesticides in school settings [34].

Although literature has been published worldwide and in the region on pediatric poisoning, there are only a few single-center reports available, with most of them published before the introduction of new methods for storing drugs at home and educating parents about the dangers of poisonings. This study aimed to provide an updated epidemiological data to study specifically the effects of parental education level, which has not been mentioned in all of the previous studies conducted in Iraq, on childhood pharmaceutical poisoning, and thus complement previous single-center reports in the region.

Objectives:

Primary objective: To identify the frequency and the age-sex-residence distribution of acute pharmaceutical poisoning in the children aged under 12 admitted to the ED.

Secondary objectives:

1. To investigate the relationship between child pharmaceutical poisoning and parents' level of education.
2. To outline the type, formulation and storage properties of the pharmaceutical agents.
3. To measure the time interval between ingestion and presentation to the hospital, to assess the caregiver's awareness.
4. To outline the clinical picture, emergency management, and the prognosis of poisoned children.

2. Patients and Methods

Study Design and Setting

This study was a prospective, descriptive (cross sectional) study done in the emergency department of a children's teaching hospital in Baghdad city, following the STROBE guidelines for observational studies. The aim of this study was to describe the frequency and pattern of pharmaceutical poisoning in this population and so a descriptive design was used.

Study Period

The data was gathered over a period of 6 months from 1 January 2016 to 1 June 2016. Since this period is not a complete calendar year, it is impossible to determine the seasonal variation in poisoning incidence; this will be taken up again in the Limitations section.

Study Population and Sampling

All consecutive children who were eligible at the time of the study were recruited (n=112). There was no prior sample size or power calculation because the sample was consecutive rather than selected from a defined sampling frame and is of hospital-based patients; the adequacy of this sample size is discussed in the Limitations section.

The inclusion and exclusion criteria are presented in the following section:

Inclusion criteria: children <12 years admitted to the ED with a history or clinical evidence of accidental ingestion of a pharmaceutical agent.

Exclusion criteria: poisoning by non-pharmaceutical agents (e.g., household chemicals, kerosene, pesticides); poisoning by an unknown or unidentified agent; repeat admissions of the same child during the study period, which were counted once; suspected intentional poisoning or self-harm; suspected child abuse; children 12 years or older.

Data Collection

Prospective data was gathered for each patient and included information on age, sex, place of residence, parental education, drug ingested (type and formulation), time to presentation after ingestion, location of drug ingestion, location and accessibility of drug storage, emergency department action, duration of hospitalization and outcome.

Age was divided into three categories: under 1 year, 1-5 years, and over 5 years. The residence was determined as urban or rural. Parental education was classified as illiterate, can read and write only, primary school, secondary school or university. The form of the drug was recorded as syrup, tablet, capsule, or drops. The type of drug was categorized by pharmacological action: cough and antihistamine preparations, analgesics, antibiotics, tonics, antiepileptics, antidepressants, antipsychotics, antihypertensives, anticoagulants, antiemetics, oral contraceptives, oral hypoglycemics or mixed preparations.

Prior literature was used to classify these drugs as either reachable or unreachable to the child, with a threshold of 150 cm. Time of presentation was divided into less than 1 hour, 1–5 hours, 5–10 hours, and more than 10 hours after ingestion. The bedroom, kitchen or other rooms (living room, bathroom, dining room) where the ingestion occurred were recorded. Clinical presentation was classified by the most severely involved system of the body (cardiovascular, central nervous, gastrointestinal, hematological, mixed, and other systems).

The immediate treatment in the ED was related to the main intervention carried out (gastric lavage, antidote therapy, observation and supportive care, or discharge without intervention) and depended on the hospital's resources. The outcome of hospitalization and length of stay was mapped as: discharged well within 24 hours; admitted to ward for over 24 hours; admitted to intensive care unit; or death.

Parents/guardians were informed about the purpose of the study and information was obtained directly from parents/guardians through history-taking and examination.

In this study, the poisoning agent was only taken as pharmaceutical agents, and cases of poisoning by unknown substances were not included.

Ethical Considerations

The hospital institutional ethics/research committee gave approval for the study before collecting the data. Parents/guardians of each child gave verbal informed consent, with the purpose and procedures of the study explained, and data from children were kept confidential throughout.

Statistical Analysis

Collected data were analyzed using SPSS software version 23. Categorical comparison was done between the variables using chi-square test with p value <0.05 taken as statistically significant. Only univariate analysis was performed in this study; the implications of this are discussed in the Limitations section.

3. Results

Of all the children who met the inclusion criteria within the 6-month study period, 112 children were included in the analysis. Results are displayed below, by the variable.

Gender Distribution

There were 68 males (60.71%) and 44 females (39.29%), with the difference between these two groups being statistically significant ($\chi^2 = 4.588$, $p < 0.05$).

Table 1. Distribution of Poisoning Cases by Child Gender (n = 112)

Child gender	Number of poisoning cases	Percentage
Male	68	60.71 ^A
Female	44	39.29 ^B
X ²	4.588	

Different superscript letters denote a statistically significant difference at $p < 0.05$. Total n = 112.

Residence

There were a higher number of children exposed to poisoning in urban areas (95, 84.82%) compared to rural areas (17, 15.17%) with a statistically significant difference ($\chi^2 = 48.516$, $p < 0.05$) (Table 2).

Table 2. Distribution of Poisoning Cases by Residence (n = 112)

Residence	Number of poisoning cases	Percentage
Urban	95	84.82 ^A
Rural	17	15.17 ^B
X ²	48.516	

Different superscript letters denote a statistically significant difference at $p < 0.05$. Total n = 112.

Reachability of the Drug to the Child

The difference between drugs stored within the reach of the child (<150 cm) and drugs stored out of the child's reach (>150 cm) was statistically significant ($\chi^2 = 32.673$, $p < 0.05$) with 78.58% of the drugs stored within the reach of the child and 21.42 % of the drugs stored out of the reach of the child (Table 3).

Table 3. Distribution of Poisoning Cases by Accessibility of Drug Storage to the Child (n = 112)

Reachability	Number of poisoning cases	Percentage
Reachable	88	78.58 ^A
Not reachable	24	21.42 ^B
X ²	32.673	

Different superscript letters denote a statistically significant difference at $p < 0.05$. Total n = 112.

Place of Drug Storage

There was a significant difference between the most common storage locations associated with poisoning, with the bedroom being the most common (63 cases, 56.25%), the kitchen being second (34 cases, 30.35%), and other rooms being third (15 cases, 13.39%) ($\chi^2 = 27.95$, $p < 0.05$) (Table 4).

Table 4. Distribution of Poisoning Cases by Site of Drug Storage (n = 112)

Storage site	Number of poisoning cases	Percentage
Bedroom	63	56.25 ^A
Kitchen	34	30.35 ^B
Other	15	13.39 ^C
X ²	27.95	

Different superscript letters denote a statistically significant difference at $p < 0.05$. Total n = 112.

Parental Education

As for paternal education, the frequencies of poisoning cases were: 32 (28.57%), 31 (27.67%), 22 (19.64%), 20 (17.85%), and 7 (6.25%) in primary school, university, illiterate, secondary school, and "read and write only" categories, respectively. No statistically significant difference ($p > 0.05$) was found across paternal education levels, except for the "read and write only" group, which differed significantly (Table 5).

Table 5. Distribution of Poisoning Cases by Paternal Educational Level (n = 112)

Father's education	Number of poisoning cases	Percentage
Illiterate	22	19.64 ^A
Read & write	7	6.25 ^B
Primary school	32	28.57 ^A
Secondary school	20	17.85 ^A
University	31	27.67 ^A
X ²	16.308	

Different superscript letters denote a significant difference at $p < 0.05$; identical letters denote no significant difference. Total n = 112.

In the case of maternal education, those with their mother being an illiterate were found to have the highest number of cases (47.32%), followed by those whose mother was a primary school graduate

(23.21%), "read and write only" (14.28%), university (9.82%) and secondary school (7.14%). There was a statistically significant correlation between the level of maternal education and the number of poisoning cases by this distribution (Table 6).

Table 6. Distribution of Poisoning Cases by Maternal Educational Level (n = 112)

Mother's education	Number of poisoning cases	Percentage
Illiterate	53	47.32 ^A
Read & write	16	14.28 ^{BC}
Primary school	26	23.21 ^B
Secondary school	8	7.14 ^C
University	11	9.82 ^C
X ²	51.97	

Different superscript letters denote a significant difference at $p < 0.05$; identical letters denote no significant difference. Total n = 112.

4. Discussion

The results of this study are discussed below with the literature available on the region and internationally, focusing on the points of similarity, difference, and reasons for differences in settings.

Pharmaceutical ingestion cases accounted for about 0.96% (112 cases) of all the cases admitted to the ED out of 11688 admissions in the six-month study period.

I. Gender

In this study, male children were more susceptible to poisoning (60.71%) than female children (39.29%) as reported by Al Hifzi et al. [18] from Saudi Arabia, Almarzoki and Mueen (66.5%) [19] in Iraq, Maatook (57.6%) [20] and similar results from Turkey and Pakistan [21]. This could relate to a higher risk of behavioral activity and risk-taking among boys while girls may neglect to follow parental instructions as much.

II. Residence

In the present study, most cases were found to be living in urban area (84.82%) and the rural area had 15.17%. This is similar to that of Alazab et al. [6] who reported 79.9% from urban areas and Mohammed A. [22] who reported 78% from urban areas for Iraq, and Almarzoki and Mueen [19] who reported 76.9% from urban areas for Iraq.

III. Age

The majority of cases in this study were in children aged 1-5 years (81.25%), similar to the study performed in Turkey by Ozdogan et al. [23], the study by Alije et al. in Kosovo reported 74% under 5 years [8], the study by Al-Barraq and Farahat in Saudi Arabia indicated 52.9% [24] and the study by Maatook in Iraq showed 71.5% [20]. This may be related to more activity in this age group and children following their parents' lead when exploring the environment.

IV. Education of Parents

This study shows that there was an association between parental education and childhood drug ingestion; 47.32% of the poisoned children were in association with illiterate mothers and less than 10% of them were in association with mothers with university education. Similar results were obtained in the Pakistani study done by Manzar et al., where over 50% of the children who were poisoned had illiterate mothers [25].

In contrast, the study conducted by Alazab et al. showed that children of mothers who had completed the secondary school had a higher prevalence of poisoning (20.6%) than those of mothers who had completed university (18.5%) and those of illiterate mothers (12.2%) [6].

This affiliation may be a reflection of the importance of the mother in the supervision of her young child in the local sociocultural context. In this study, the education level of the father did not significantly correlate with frequency of poisoning. These associations are descriptive and should not be viewed as proven causal risk factors.

V. Site of Poisoning

The results of this study showed that most cases were seen in the bedroom (56.25%) while the kitchen (30.35%) was the predominant site in the Egyptian study by Alazab et al. [6]; other locations accounted for 13.39%. This difference may be due to differences in live social life and drug-storage habits of the households in the settings.

VI. Reachability

The level of access to the drug (i.e. the safety of the drug storage) found that 78.58% of cases had access to the drug, which was similar to that of Alazab et al. [6].

VII. Drugs

The most frequent drugs involved in poisoning (13.39%) in this study were analgesics, which were also the most prevalent drugs involved in poisoning in the Maatook study (13.20%) [20], as well as in the Spanish study by Mintegi et al. (15.3%) [26], and in studies in Malaysia [27], United States, Turkey, and Oman. This could be due to the fact that these medications are widely available (both by prescription and over the counter). This is contrary to the study of Alazab et al., who reported predominance of antiepileptics (14%), analgesics (11.7%) [6] and the Iraqi study by Mohammed A., who reported predominance of antihypertensive medications (24.4%) followed by cold and cough preparations (12.8%) [22].

The second most common class of drugs was the antiepileptics, which was not the same as the Alazab et al. study above [6], which had antiepileptics as the most common class of drugs. Tonics and cough medicines were the third most commonly used remedies, similar to the findings of the Egyptian study by Hassan and Siam [28] and the Australian study by Chien et al. [29]

VIII. Drug Formulation

In this study, the most frequently reported formulation of poisoning was tablets (68.75%) as opposed to syrup formulations (25.89%), which may be due to the fact that tablets are much more extensively available in the home environment and are also much more easily accessible than formulations that are usually more securely stored.

IX. Time of Presentation

In this study, the majority of cases occurred within 1-5 hours (48.21%) of ingestion and 23.21% occurred within one hour. The Egyptian study by Alazab et al. reported the most common time of presentation 2–4 hours after ingestion (65.5%) [6], while the Turkish study by Ozdogan reported a comparable pattern, with 52% presenting within a similar early timeframe [23]. The Palestinian study by Ghaleeb reported over 90% of cases presenting within the first hour [30], while the Spanish study reported 61.3% presenting within 1 hour and 78.9% within 2 hours [26]. This disparity could reflect a reduced local recognition of the dangers of drug ingestion by caregivers or have to do with the time it takes to get to hospital due to congestion and traffic, which is a potential public health education target.

X. Symptoms

In our study, the majority of children (more than 46%) came with no complaints or concerns, a similar result to that of the Isa study (44.4%) [31], the Spanish study by Mintegi et al. (70.8%) [26] and the Qatari study by Dawod et al. (51.7%) [32]. This may be related to parents vomiting after ingestion or to the small amount ingested or to analgesics being the most common class of drug ingested. The second most frequent presentation was gastrointestinal (nausea, vomiting) (18.75%), followed by central nervous system (16%) which is similar to the findings of the Turkish study by Ozdogan et al. [23].

XI. Emergency Department Management

For the majority of cases (54.46%), only supportive care was used for treatment, and gastric lavage was only used in 35% of cases, compared to the Isa study (35.2%) [31]. A smaller proportion was reported in the study by Mintegi et al. (26.9%) which used other measures to a greater extent such as activated charcoal (81.8%) and syrup of ipecac (24%) [26] (not available at this hospital). Gastric lavage with administration of antidote was performed in 9.8% of cases that is higher than 3.8% [26] but similar to 10% reported by Mohammed A. [22].

XII. Outcome

The majority of cases in this study were discharged home within 24 hours, and fewer than 25% of cases were admitted beyond 24 hours, of which 1.78% were admitted to intensive care. In a similar situation, Mohammed A. reported a comparable proportion of children discharged home within 24 hours [22]. Ghaleb [30] and Ozdogan et al. [23] perhaps indicated that most exposures in young children are accidental with small amounts ingested [33]. In this study, intensive care admission was low (1.78%) compared to the Spanish study by Mintegi et al. [26] which reported 1.5% and the study by Bashier et al. [28] which reported 3.7%. As in the Maatook study [20], there were no deaths recorded in this study compared to 1.4% in the Al Hifzi study [18] and 2% in the Ozdogan et al. study [23].

5. Limitations

There are certain limitations of this study that needs to be taken into consideration when interpreting the findings:

1. The findings are from a single-centre, hospital-based design which may not be generalizable to the wider paediatric population in Iraq.
2. Study duration: the duration of the study was limited to six months and may not reflect the seasonal variation in the incidence of poisoning, which would be advisable in future studies to be longer or the entire year.
3. Sample size: There was no prior sample size or power calculation; the size of the sample of 112 patients used may not be adequate to detect all associations of interest.
4. Selection bias: Only children admitted to hospital were observed; children with less severe symptoms that were treated at home or as outpatient were not included, which may have skewed the severity and presentation seen.
5. Statistical approach: Chi-square analysis was performed in only the simplest univariate way, without the adjustment for other potential factors such as socioeconomic status, parent occupation or family size; effect sizes (odds ratio and relative risk) as well as exact p-values with 95% confidence interval (CI) are recommended for future studies to identify independent associations.
6. Causal inference: Since this is a descriptive, non-experimental study, there are no causal claims of relationships reported here (showing maternal education, for example, to be a risk factor, for instance) and should be understood as observed associations only.
7. Base: Several of the comparative studies used are more than 10 years old, and more recent regional data were not available for all comparisons.

Suggestions for future research

1. Future research should take place for an entire calendar year or several years to reflect seasonal trends in what may be poisoning.
2. To gain generalisability beyond a single tertiary hospital, studies of multiple centres should be carried out in various governorates of Iraq.
3. Prospective studies with a priori sample size calculation and multivariable logistic regression analysis are recommended to be performed to identify independent associations and to adjust for the presence of confounder variables like socioeconomic status, family size and parental occupation to provide exact p-values, 95% confidence intervals and effect sizes (odds ratios/relative risks).
4. Community-based studies that include children in settings outside of the hospital would help to overcome the selection bias of hospital-based samples.
5. Targeted parental health-education activities, especially those for mothers with low levels of formal education, should be assessed for their effect on the frequency of childhood drug poisoning in the future.

6. Conclusions

1. Acute pharmaceutical poisoning is an important presentation at the ED of all countries including this one.

2. Boys were more likely to become poisoned than girls; children from urban areas were more likely to be poisoned than those from rural areas and children aged 1–5 years were most likely to be poisoned.
3. The highest proportion of poisoning cases were found to be those of maternal illiteracy, although no consistent association was seen for paternal education level; these are observed associations, not causal risk factors.
4. Class of most commonly ingested drugs was analgesics, followed by antiepileptics, tonics and antibiotics, and the most common formulation was tablets.
5. The majority of children who were brought to the ED after ingestion were seen within 1-5 hours.
6. No deaths were reported, most children presented were asymptomatic and required only monitoring/observation before discharge, a small number required to be admitted to intensive care
7. The results of the present study are from one tertiary center and one six-month time frame and should only be extended to the general pediatric population of Iraq with precaution.

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Conflict of Interest

The authors do not have any conflict of interest.

Data Availability Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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