

Original Research Article

Accidental household poisoning in children: shedding light on the common agents and risk factors

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ABSTRACT

Background: Household poisoning is one of the leading causes of accidental injuries in children. The cause may vary between different countries. The aim of the study was to identify the causative agents as well as risk factors pertaining to our country such as social, demographic, cultural factors and local customs.

Methods: This was a descriptive cross-sectional study. All children in the age group of 6 months to 12 years with established diagnosis of acute accidental known household poisoning were included in the study group.

Results: Most of the children with accidental poisoning were in the age group of less than 2 years (56.8%), with male preponderance (66.7%). The commonest poisoning agent was kerosene in 45% of the children followed by detergents (9%), drugs (8.1%), paint thinner (7.1%) and ant chalk (4.5%). In 62.2% of cases poisons were not in original container. Socio-demographic factors such as parents' education status, mother's employment or type of family did not show significant correlation.

Conclusions: Accidental poisoning is a preventable cause of morbidity and rarely even mortality in children. Awareness needs to be generated amongst parents about simple but effective measures in the household to prevent such incidents. Given the pandemic, the presence of children at home constantly increases the importance of vigilance regarding this public health issue.

Keywords: Accidental poisoning, Household poisoning, Ingestion, Intoxication, Poisoning agents

INTRODUCTION

Acute poisoning in children is an important pediatric emergency and is a world-wide problem.¹ The type of poisoning is different in developed and developing countries, and it depends upon various factors.²

Though poisoning in children is largely accidental, it is an important public health issue which has significant costs, both financial and emotional.¹ There are many studies available regarding poisoning in developed countries but in developing countries, data is lacking and due attention has not been given to determine the extent of problem it is creating in the community.³ It is reported that accidental poisoning accounts for 0.3-7 per 1,00,000 deaths in developing countries in children.⁴ Boys are more likely to

be involved in accidental poisoning than girls.⁵ However, studies regarding accidental household poisoning are scanty in our Indian setup. In a study conducted by Khadka et al, poisoning is responsible for more than 25% of accidental deaths in the 1-15 years age group.⁶ The reasons implicated are easy availability, improper storage and other factors such as social, cultural and demographic characteristics.

Regarding the type of agents involved volatile hydrocarbons (mostly kerosene and turpentine, spirit) accounted for the highest proportion of poisonings, followed by agricultural pesticides like organophosphates, carbamates, and drugs.⁷ Household insecticides and rodenticides like pyrethroids, zinc phosphide/rat poison, household cleaning agents e.g. phenyl, detergents,

disinfectants, and corrosives like hydrochloric, sulfuric and nitric acids were the other substances implicated.⁸ Among drugs and pharmaceutical agents responsible, the most important ones implicated were acetaminophen and sedatives.⁸ All these changes in the last two decades are attributed to increase in industrialization and urbanization resulting in the exposure to various hazardous agents, and it is expected to go up if no preventive measures are taken like public health education and improvement in the socio-demographic condition.⁶ The epidemiological surveillance specific to each country is required to know the factors responsible for poisoning and to establish preventive measures.⁹ The objective of this study was to identify the causative agent, and studying the socio-demographic factors in children between 6 months to 12 years of age with known accidental poisoning.

METHODS

Study design

Descriptive cross-sectional study conducted at Sri Manakula Vinayagar Medical College and Hospital, a tertiary care centre in Puducherry, India.

Study period

This study was conducted between October 2016 and June 2018 after obtaining approval from Institutional Ethics Committee.

Study participants

All children in the age group of 6 months to 12 years with established diagnosis of acute accidental known household poisoning were involved in the study group.

Sample size

Sample size was calculated using the formula-

$$\frac{4 \times p \times q}{L^2}$$

keeping the prevalence from the study conducted by Manzar et al as 5%, at 95% confidence interval and allowable error as 5%.¹⁰

Sample size required for the study was 76. Taking a non-response rate of 10% the sample required for the study came to 102.

Inclusion criteria

Patients included were as follows- (a) children who were brought alive to casualty room; (b) both sexes, in the age group of 6 months-12 years with the positive diagnosis of acute household poisoning; and (c) known household poisoning agent.

Exclusion criteria

Patients excluded were those who had following- (a) poisoning due to insect bite, animal bite or snake bite; (b) non-accidental poisoning; (c) when definitive history of ingestion of household poisoning is not available; (d) poisoning due to exposure through other routes like ear, nasal or ocular; (e) children with intermittent illness like vomiting or diarrhea; and (f) children with known renal or liver disease.

Data collection procedure

The study was a cross sectional study conducted in all children aged 6 months-12 years admitted in the emergency department with the history of accidental known household poisoning which fulfilled the inclusion criteria, from October 2016-June 2018. The parents/caregivers of the child were explained in detail regarding the benefits and associated risks involved in the study in detail. Information regarding the study was provided in both English as well as in local language and consent was obtained.

Detailed history included the following details like age, sex, residence, time of presentation, symptomatology and type of poison. The socio-demographic risk factors like age of mother, education status, urban or rural area, nuclear or joint family, family income, whether the incident occurred in the own house or neighboring house, wherein the offending agent was kept in the reachable/unreachable area are recorded in the predesigned proforma. Clinical assessment of children included general examination and systemic examination. The children were periodically monitored and vital parameters were recorded. Tests like chest X-ray, blood electrolytes, blood sugars, prothrombin time, activated partial thromboplastin time, International normalised ratio (INR), complete blood count, liver function tests were done depending on the type of poisoning and when clinically indicated. The children were observed for complications, the duration of hospital stay and mortality.

Statistical analysis

The collected data was entered using Microsoft excel sheet and analysed using Epi-info version 7.2.2.6. Proportion, frequency, mean and standard deviation were calculated. Chi square test was used for statistical analysis.

RESULTS

During the study period there were 111 children who were admitted with poisoning. More of the children were in the age group of less than 2 years (56.8%), whereas those above 2 years of age made up 43.2%. All the children were admitted in the paediatric intensive care unit with the duration of hospital stay from 1-3 days (93.7%). A male preponderance was observed (66.7% male, 33.3% female). 55% of children were brought from the rural background,

with caretaker being mother (77.5%), who was not employed (62.2%) and they live in joint family (91%). Table 1 shows distribution of socio-demographic factors. The commonest poisoning agent was kerosene in 45% of the children followed by detergents (9%), drugs (8.1%), thinner (7.1%), ant chalk (4.5%) and others as seen in Figure 1. Poisons were accidentally consumed commonly between 8 am to 4 pm (94.6%) and it was mostly consumed in their respective homes (70.3%). Most common location of agent was in the kitchen (62.2%) and it was located at a reachable distance of less than 50 cm (82%). More than 62.2% of cases poisons were not in original container.

Table 2 shows distribution of factors related to the poisoning agent. Majority of the children presented with cough (64%) and many are irritable (68.5%) at the time of presentation while 5.4% presented with seizures at the time of presentation as seen in Figure 2. 36% of the children were brought to hospital within 2 hours of exposure of the agent. 93.7% got discharged within 3 days without any sequelae. Analysis of association with male gender showed a significant association while other demographic characters like parent's education, employment status of the mother, type of family had not shown any significant relationship.

Table 1: Socio-demographic characteristics of study participants and their parents.

| Sociodemographic factors | Number (N) | Percentage (%) |
|---------------------------------|------------|----------------|
| Total | 111 | 100.0 |
| Age group in years | | |
| <2 | 63 | 56.8 |
| ≥2 | 48 | 43.2 |
| Gender | | |
| Male | 74 | 66.7 |
| Female | 37 | 33.3 |
| Place of residence | | |
| Urban | 50 | 45 |
| Rural | 61 | 55 |
| Mother's education | | |
| Read or write | 4 | 3.6 |
| Primary | 20 | 18 |
| Secondary | 83 | 74.8 |
| Graduate | 4 | 3.6 |
| Father's education | | |
| Primary | 4 | 3.6 |
| Secondary | 77 | 69.4 |
| Graduate | 30 | 27 |
| Mother's employment | | |
| Not working | 69 | 62.2 |
| Working | 42 | 37.8 |
| Father's employment | | |
| Not working | 0 | 0 |
| Working | 111 | 100.0 |
| Caretaker | | |
| Mother | 86 | 77.5 |
| Others | 25 | 22.5 |
| Family type | | |
| Nuclear | 10 | 9 |
| Joint | 101 | 91 |
| Number of family members | | |
| 3 | 9 | 8.1 |
| 4 | 11 | 9.9 |
| 5 | 49 | 44.1 |
| 6 | 31 | 27.9 |
| 7 | 11 | 9.9 |
| Nursery | | |
| Not attending nursery | 109 | 98.2 |
| Attending nursery | 2 | 1.8 |

Table 2: Factors related to poisoning agent.

| Time, place of occurrence of poisoning | Number | Percentage (%) |
|--|--------|----------------|
| Total | 111 | 100.0 |
| Time of exposure | | |
| 8 am-4 pm | 105 | 94.6 |
| 4pm-12 pm | 6 | 5.4 |
| Place of occurrence | | |
| Grandparents' house | 28 | 25.2 |
| Parents house | 78 | 70.3 |
| Others | 5 | 4.5 |
| Location of poisoning | | |
| Bathroom | 12 | 10.8 |
| Bedroom | 4 | 3.6 |
| Kitchen | 69 | 62.2 |
| Others | 26 | 23.4 |
| Reachability to poison in cm | | |
| <50 | 91 | 82 |
| >50 | 20 | 18 |
| Condition of container | | |
| Locked | 69 | 62.2 |
| Unlocked | 42 | 37.8 |
| Status of container | | |
| Original | 69 | 62.2 |
| Not original | 42 | 37.8 |

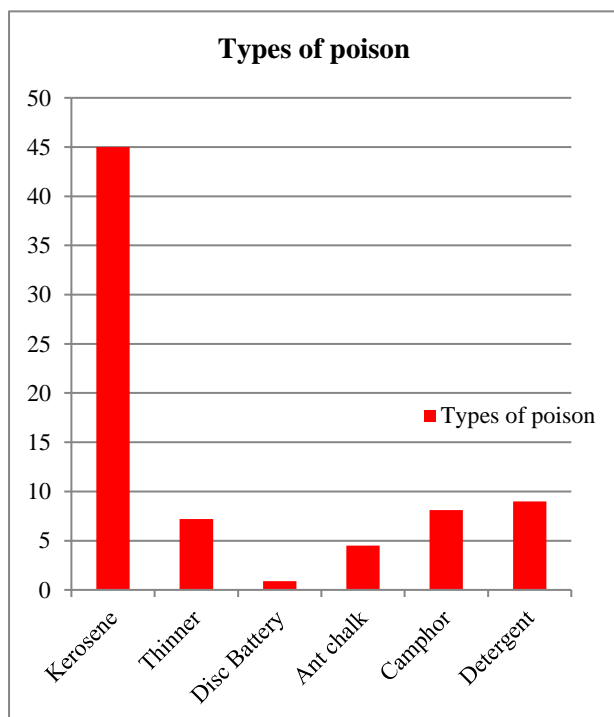


Figure 1: Percentage distribution of the poisoning agents.

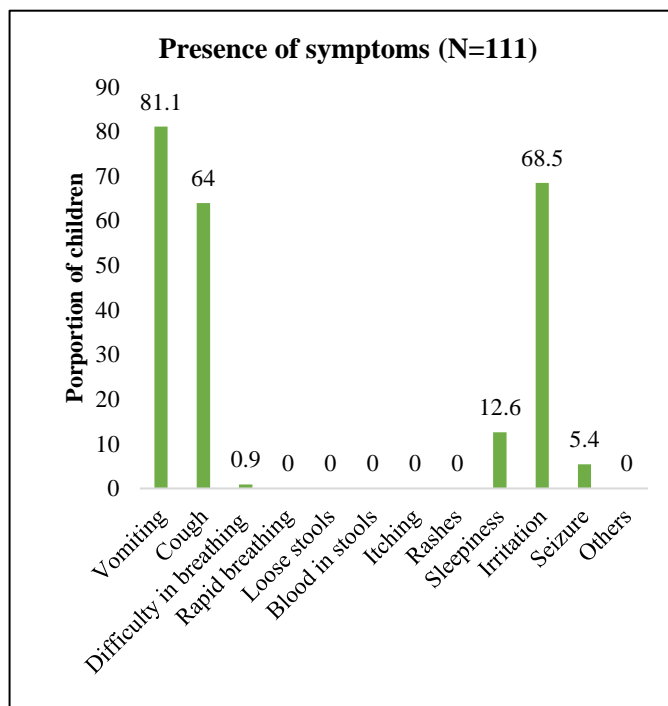


Figure 2: Percentage distribution of presenting complaints.

DISCUSSION

Accidental poisoning remains an important health issue in children globally and more so in developing countries like India. Identification of socio-demographic characters and

other variables in case of accidental household poisoning is of great importance for providing appropriate preventive health education.¹¹ Hence this cross-sectional study was conducted in our tertiary care center which serves both the urban and rural areas, especially because of less studies

done in South India. Socio-demographic characters like age, gender, education of parents, income of family, family type, as well as location of poison, reachability and other factors were studied to predict the risk factors for accidental ingestion of poisoning.^{12,13}

In our study male to female ratio was 2:1 approximately which were consistent with previous studies conducted by Baqir et al.¹⁴ In our study children <2 years were more commonly encountered with accidental household poisoning, which was 56.8% of the study population.¹⁴ This is attributed due to the child's ability to move independently and its contact with objects around them and explore the surroundings not only through eyes, but also through touch and taste, without being aware of the risk that may arise.¹⁴

In our study the children we encountered were mostly belonging to the rural areas, where 55% of children were brought from the rural background. Predominantly, caretaker was mother (77.5%) who were not employed (62.2%) belonging to joint family (91%). This is due to lower health education of the population in the rural areas and wide usage of chemicals in agriculture. In a study conducted by Agrawal et al, he was able to find out similar results with children exposed to poisonous substances more in the rural areas with 65.54% of the study population.¹⁰

In our study 91.9% of poisoning was caused due to household materials and 8.9% were due to ingestion of drugs. In our study volatile hydrocarbons in general and kerosene in particular was the most commonly encountered poisoning agent followed by bathroom cleaners and pharmaceutical products which did not differ much from the studies conducted by Sil et al.⁹

Risk factors evaluated in our study revealed improper storage (82%) placed within reachable distances from the ground, and unlocked containers (37.8%), unsafe containers (37.8%) of the offending agent in which they were kept in colored bottles and in accessible areas in the house.¹⁵ Along with it, lack of proper education in mother and family support were also found out which were consistent with the study conducted by Dayasiri et al done in rural Sri Lanka.¹⁶

In our study the common symptomatology was cough (64%), vomiting (81.1%), many children were irritable at the time of presentation while 5.4% children in our study presented with seizures. Similar observation was noted in study done by Agarwal et al in India.¹⁰ The severity of the clinical manifestations depends upon the dose, manner of usage and time period of medical assistance.

In our study 36% of the children presented to our hospital within 2 hours, 30.6% within 2-4 hours and 23% after 4 hours after the symptoms developed. Poisoning generally is associated with more morbidity than mortality. In our study, we found one case of disc battery ingestion who had

grade-III mucosal injury with prolonged hospital stay of more than one month.

Though in our study only few cases had morbidity and no mortality was found, in a study carried out by Nabeel Manzar et al mortality recorded was 11.6%.¹¹ Apart from the socio-demographic factors like mother's education, knowledge regarding poison, storage place and type of family also contribute to the accidental ingestion of poisoning.¹⁷ Though in our study no significant association was found between the educational status of the mother and ingestion of poison, they do not reflect the true statistics in the population which is a limitation we found because of the smaller sample size and single centre approach. As per a meta-analysis done by Cochrane study group to assess the effect of home safety education and provision of safety equipment, such poison prevention practices were effective in increasing safe storage of medicines.¹⁸ They also revealed educational programs were successful in improving the knowledge, attitude and practices of general public for prevention of poisoning. There is also a continuous need for more awareness about storage, safe handling and prevention of poisoning in larger population.¹⁸

In India, National Poison Information centre is providing services to the professionals and general public regarding the management of various poisonings. This centre was established in India in 1995, and is catering these services to the society. However there has been under reporting and utilization due to the social stigma involved in poisoning. Though this information centre had been run by the government, proper utilization has to be done by the people for reducing the burden caused by poisoning in the society.

There are certain limitations in the study such as lower sample size and single center approach and the population involved in the study was mostly from rural areas, so this study does not reflect the true statistics involved in the population as a whole. A large-scale multi-center study covering a large geographical area and a community-based approach may be helpful in finding out the precise risk factors involved in the accidental ingestion of household poisoning in children.

CONCLUSION

Accidental household poisoning is more common in children below 2 years of age and predominantly in males. Most common agent was kerosene, with risk factors being storage in accessible area and height, and non-original containers being used. Education of parents, adequate storage of potentially hazardous substances and parental supervision could be the most important activities for prevention of childhood poisoning. From our practice it is evident that the society is not well informed regarding the poisoning in general. Therefore, written and electronic media as well as other methods should be used for promoting health education.

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REFERENCES

1. Yaqoob M, Yar M, Farooq M, Butt AR, Waseem R, Izhar TS. Acute poisoning in children: etiological agents, risk factors and outcomes. *Pak J Med Health Sci Mar.* 2007;1(1):42-4.
2. Winston AB, Das AD, Das S, Vazhudhi K, Kumar A, Shanthi FM, Agarwal I. Drug poisoning in the community among children: a nine years' experience from a tertiary care center in south India. *Hosp Pract (1995).* 2017;45(1):21-7.
3. Meyer S, Eddleston M, Bailey B, Desel H, Gottschling S, Gortner L. Unintentional household poisoning in children. *Klin Padiatr.* 2007;219(5):254-70.
4. Dayasiri MBKC, Jayamanne SF, Jayasinghe CY. Risk Factors for Acute Unintentional Poisoning among Children Aged 1-5 Years in the Rural Community of Sri Lanka. *Int J Pediatr.* 2017;4375987.
5. Pirzadeh Z, Jamshidi M, Mollamohammadi M. Acute poisoning in children referred to Qazvin Children Hospital (2009 to 2012). *Comprehensive Pediatrics.* 2016;7(4).
6. Khadka SB, Khadka SB. A study of poisoning cases in emergency Kathmandu Medical College Teaching Hospital. *Kathmandu Univ Med J (KUMJ).* 2005;3(4):388-91.
7. Gupta SK, Peshin SS, Srivastava A, Kaleekal T. A study of childhood poisoning at National Poisons Information Centre, All India Institute of Medical Sciences, New Delhi. *J Occup Health.* 2003;45(3):191-6.
8. Sil A, Ghosh TN, Bhattacharya S, Konar MC, Soren B, Nayek K. A study on clinico-epidemiological profile of poisoning in children in a rural tertiary care hospital. *J Nepal Paediatr Soc.* 2016;36(2):105-9.
9. Agarwal G, Bithu K, Agarwal R. An epidemiological study of acute poisoning in children in a tertiary care hospital of western Rajasthan, India. *Int J Contemp Pediatrics.* 2016;3:1249-51.
10. Manzar N, Saad SM, Manzar B, Fatima SS. The study of etiological and demographic characteristics of acute household accidental poisoning in children-a consecutive case series study from Pakistan. *BMC Pediatr.* 2010;10:28.
11. Schwebel DC, Evans WD, Hoeffler SE, Marlenga BL, Nguyen SP, Jovanov E, et al. Unintentional child poisoning risk: A review of causal factors and prevention studies. *Children's health care.* 2017;46(2):109-30.
12. Mansori K, Soori H, Farnaghi F, Khodakarim S, Mansouri HS, Khodadost M. A case-control study on risk factors for unintentional childhood poisoning in Tehran. *Med J Islam Repub Iran.* 2016;30:355.
13. Baqir H, Baig MA, Brown N, Mian AI. Accidental Poisoning in Young Children: an Emergency Medicine Perspective for Pakistan and Other Low- and Middle-Income Countries and a Call for Action. *Eurasian J Emerg Med.* 2017;16(4):140.
14. Naik BN, Veerakumar AM, Manikandan S, Kar SS. Prevalence of Domestic Poisoning in a Rural Area of Tamil Nadu. *Indian J Forens Med Toxicol.* 2016;10(1).
15. Bojd S, Khajeh A. Chronological variations of children poisoning causes in zahedan, South of iran. *Int J High Risk Behav Addict.* 2014;3(3):19223.
16. Dayasiri KC, Jayamanne SF, Jayasinghe CY. Patterns of acute poisoning with pesticides in the paediatric age group. *Int J Emerg Med.* 2017;10(1):22.
17. Osborne PG, Ko YC, Wu MT, Lee CH. Intoxication and substance use disorder to Areca catechu nut containing betel quid: A review of epidemiological evidence, pharmacological basis and social factors influencing quitting strategies. *Drug Alcohol Depend.* 2017;179:187-97.
18. Stewart TC, Clark A, Gilliland J, Miller MR, Edwards J, Haidar T, Batey B, et al. Home safe home: Evaluation of a childhood home safety program. *J Trauma Acute Care Surg.* 2016;81(3):533-40.

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