



## **Acute Childhood Poisoning in Azare North Eastern Nigeria**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author IAMI conceptualized and designed the study, wrote the protocol, did the statistical analysis and wrote the draft of the manuscript. Authors DSA, ME, II and AA collected the data. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aim:** To describe the clinical profile of acute poisoning amongst children admitted into the Federal Medical Centre Azare, Nigeria.

**Study Design:** Cross-sectional retrospective.

**Place and Duration of Study:** The study was conducted at the department of paediatrics, Federal Medical Centre, Azare, Nigeria from 1<sup>st</sup> January 2013 to 31<sup>st</sup> December 2017.

**Methodology:** Medical records of children admitted with complaints of undue exposure to poison agents were retrieved and analysed. The information collected includes, the age, sex, poisoning agent, place of occurrence of the event, the time between occurrence and presentation to the hospital, route of poisoning, circumstances of the event, presenting symptoms, elicited clinical signs, outcome, and duration of hospital stay. The collected data was analyzed using SPSS version 20.0.

**Results:** Acute poisoning accounted for 0.68% of the total admissions giving a prevalence of 684 per 100,000. The male to female ratio was 1.4:1. The children were aged 9 months to 12 years. However, the majority of subjects (73.2%) were aged 1-4 years.

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The most frequently encountered poison agent is organophosphate with kerosene being the next most common. Vomiting was most indicative of organophosphate poisoning while cough, dyspnea, and tachypnea were indicative of kerosene poisoning. Thirty-eight patients (92.7%) were successfully managed and discharged without sequelae. One death was documented, giving a mortality rate of 2.4%. The relationship between poison agents and outcome was statistically significant ( $\chi^2 = 22.55$ ,  $df = 10$ ,  $P = .013$ ).

**Conclusion:** Acute childhood poisoning is more common in Azare than most other parts of Nigeria. Organophosphates constitute the most frequent poison agent. However, kerosene poisoning is the most likely to cause mortality.

*Keywords: Acute poisoning; childhood; organophosphate; kerosene; azare; Nigeria.*

## 1. INTRODUCTION

Children are often exposed to hazardous substances in our residences and the environs. This reflects the reality especially in the context of poisoning. The very young are particularly at risk due to their instinctive inquisitiveness and the tendency to explore with the mouth. Hence childhood acute poisoning is a public health problem worldwide [1,2].

Poisoning denotes the harmful effects resulting from exposure to an exogenous agent that causes cellular injury or death. Poisonous agents may be inhaled, ingested, absorbed, injected or transplacentally acquired [3]. The contact may be acute or chronic with different clinical manifestations. Yet when the poisoning results from either a single exposure or multiple exposures to the substance within a short period of time (usually 24 hours) it is referred to as acute poisoning.

The epidemiology of paediatric acute poisoning varies across geographical, socioeconomic, cultural and human development divides [4-8]. Developed countries often have declining incidences and mortalities, with affected children requiring minimal intervention for good outcome [1,2,8]. Conversely, children from the developing world frequently exhibit severe manifestations [4-6,9,10]. In Nigeria, incidence figures range from 0.22%-0.94%, with kerosene and organophosphates constituting the significant agents of poisoning in children [4-6,11,12]. Local mortality rates range from 0.9%-20%, depending largely on the predominant poisoning agent [4-6, 11-13]. Whereas it is of great significance to make available up-to-date information on childhood acute poisoning in our setting, to the best of our knowledge no such study has been conducted in this part of North East Nigeria. We thus elected to study the clinical profile and outcome of children managed for acute poisoning at the Emergency Paediatric Unit

(EPU) of the Federal Medical Centre (FMC), Azare, Nigeria. It was expected that the information so derived would provide to paediatric clinicians an overview of childhood poisoning in our locale and add to the body of knowledge on poisoning in Nigeria.

## 2. METHODOLOGY

### 2.1 Study Area

The present study was conducted at the EPU of the FMC Azare, Bauchi state in North-Eastern Nigeria. The centre is a tertiary facility which serves as a referral hospital for the populations of Bauchi, Yobe and Jigawa states of Northern Nigeria [14]. Prior approval was obtained from the research ethics committee of the hospital.

### 2.2 Study Design

The current study was a cross sectional retrospective review of children admitted into the EPU of FMC Azare from 1<sup>st</sup> January, 2013 to 31<sup>st</sup> December, 2017: a 5-year period. The admission registers were applied to isolate all the children who had presented with complaints of undue exposure to poisonous agents. Subsequently, the case files of the identified children were extracted from the records library and the required data obtained with the use of a structured questionnaire. The information collected include, the age, sex, poisoning agent, place of occurrence of the event, time between occurrence and presentation to the hospital, route of poisoning, circumstances of the event, presenting symptoms, elicited clinical signs, outcome and duration of hospital stay.

### 2.3 Data Analysis

The collected data was analyzed using SPSS version 20.0. Results were presented in prose and tables. Student t-test was used to compare means and categorical data were

compared with the chi-square test. A *P* value less than 0.05 was regarded as being statistically significant.

### 3. RESULTS

Five thousand, nine hundred and ninety-two (5992) patients were seen at the EPU over the five-year period. Acute poisoning accounted for 0.68% (41 cases) of the total admissions giving a prevalence of 684 per 100,000. There were 24 boys and 17 girls among those affected by acute poisoning. Hence the male to female ratio was 1.4:1. The children were aged 9 months to 12 years with a mean age of 3.2 ± 2.7 years. The mean age for boys (3.5 ± 2.8 years) differed significantly from the 2.9 ± 2.6 years for girls (*t* = 7.716, *P* < 0.001). One child died from acute poisoning during the period under review, giving a mortality rate of 2.4%.

Table 1 outlines the general characteristics of the study subjects. It shows that 82.9% of the subjects presented to the hospital within 6 hours of the event, and that all of them (100%) individually ingested the agents. It also shows that 41.5% of the subjects were discharged after 24 hours of hospital stay. The majority of subjects (73.2%) were aged 1-4 years.

Table 2 relates the clinical symptoms with the poisonous substances and shows that vomiting was the commonest symptom and was most likely to indicate organophosphate poisoning. Breathlessness was the next most frequently encountered symptom. However, it did not indicate an affinity to a particular poison. Cough was most likely suggestive of kerosene poisoning.

Dyspnoea and tachypnoea were the commonest clinical signs and were indicative of kerosene poisoning. Oro-pharyngeal ulcerations were only found in children with caustic soda poisoning. These are shown on Table 3.

Table 4 shows that the most frequently encountered poison agent is organophosphate with kerosene being the next most common. The least commonly encountered agents are the seeds of poisonous wild plants. Thirty-eight patients (92.7%) were successfully managed and discharged without sequelae, while 2 (4.9%) were referred for further management given that they developed oesophageal strictures from caustic soda poisoning. The relationship between poison agents and outcome was statistically significant ( $\chi^2 = 22.55$ , *df* = 10, *P* = .013).

**Table 1. General characteristics of cases of acute poisoning by age**

Variables	Age (years)				Total (%)
	< 1(%)	1-4(%)	5-8(%)	9-12(%)	
<b>Sex</b>					
Male	1(2.4)	18(43.9)	2(4.9)	3(7.3)	24(58.5)
Female	1(2.4)	12(29.3)	3(7.3)	1(2.4)	17(41.5)
<b>Time elapsed before presentation</b>					
1-6 hours	2(4.9)	25(61.0)	4(9.8)	3(7.3)	34(82.9)
7-24 hours	0(0.0)	3(7.3)	1(2.4)	1(2.4)	5(12.2)
> 24 hours	0(0.0)	2(4.9)	0(0.0)	0(0.0)	2(4.9)
<b>Place of occurrence</b>					
Home	2(4.9)	29(70.7)	5(12.2)	2(4.9)	38(92.2)
Neighbourhood	0(0.0)	1(2.4)	0(0.0)	1(2.4)	2(4.9)
Farm	0(0.0)	0(0.0)	0(0.0)	1(2.4)	1(2.4)
<b>Circumstance of event</b>					
Individual accident	2(4.9)	30(73.2)	5(12.2)	4(9.8)	41(100.0)
Error of administration	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
Suicidal attempt	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
<b>Route of exposure</b>					
Oral	2(4.9)	30(73.2)	5(12.2)	4(9.8)	41(100.0)
Others	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
<b>Duration of hospital stay(days)</b>					
1	2(4.9)	12(29.3)	1(2.4)	2(4.9)	17(41.5)
2	0(0.0)	13(31.7)	1(2.4)	1(2.4)	15(36.6)
3	0(0.0)	4(9.8)	1(2.4)	0(0.0)	5(12.2)
4	0(0.0)	1(2.4)	2(4.9)	1(2.4)	4(9.8)

**Table 2. Presenting symptoms of subjects related to poison agents**

Clinical symptoms	Agent						Total N=41	P
	Organophosphate (%)	Kerosene (%)	Medicine (%)	Caustic soda (%)	Wild fruit (%)	Rodenticide (%)		
Droling of saliva	3(7.3)	0(0.0)	0(0.0)	4(9.8)	0(0.0)	1(2.4)	8(19.5)	<.001
Breathlessn-ess	7(17.1)	7(17.1)	1(2.4)	0(0.0)	0(0.0)	2(4.9)	17(41.5)	.12
Vomiting	8(19.5)	5(12.2)	2(4.9)	0(0.0)	0(0.0)	4(9.8)	19(46.3)	.02
Diarrhoea	7(17.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(4.9)	9(22.0)	.02
Unconsciou-sness	2(4.9)	1(2.4)	2(4.9)	0(0.0)	1(2.4)	2(4.9)	8(19.5)	.05
Cough	2(4.9)	6(14.6)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	8(19.5)	<.001
Abdominal pain	3(7.3)	0(0.0)	0(0.0)	1(2.4)	0(0.0)	0(0.0)	4(9.8)	.46
Dysphagia	0(0.0)	0(0.0)	0(0.0)	3(7.3)	0(0.0)	0(0.0)	3(7.3)	<.001
Drowsiness	2(4.8)	1(2.4)	2(4.8)	0(0.0)	0(0.0)	0(0.0)	5(12.2)	.46
Irrational talk	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(2.4)	0(0.0)	1(2.4)	.02
Convulsion	2(4.9)	0(0.0)	0(0.0)	0(0.0)	1(2.4)	0(0.0)	3(7.3)	<.001

**Table 3. Clinical signs of subjects in relation to poison agents**

Clinical signs	Agent						Total N=41	P
	Organophosphate (%)	Kerosene (%)	Medicine (%)	Caustic soda (%)	Wild fruit (%)	Rodenticide (%)		
Lethargy	7(17.1)	3(7.3)	3(7.3)	0(0.0)	0(0.0)	0(0.0)	13(31.7)	.20
Irritability	2(4.8)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(4.8)	.85
Coma	4(9.8)	1(2.4)	1(2.4)	0(0.0)	1(2.4)	2(4.8)	9(22.0)	.10
Dyspnoea	6(14.6)	9(22.0)	0(0.0)	0(0.0)	0(0.0)	3(7.3)	18(43.9)	<.001
Wasting	0(0.0)	0(0.0)	0(0.0)	1(2.4)	0(0.0)	0(0.0)	1(2.4)	.22
Dehydration	1(2.4)	0(0.0)	1(2.4)	1(2.4)	0(0.0)	1(2.4)	4(9.8)	.46
Pyrexia	3(7.3)	0(0.0)	1(2.4)	0(0.0)	0(0.0)	2(4.8)	6(14.6)	.15
Cyanosis	1(2.4)	1(2.4)	0(0.0)	0(0.0)	0(0.0)	1(2.4)	3(7.3)	.71
Oropharyng-eal ulceration	0(0.0)	0(0.0)	0(0.0)	3(7.3)	0(0.0)	0(0.0)	3(7.3)	<.001
Hypotonia	2(4.8)	1(2.4)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(7.3)	1.00
Tachypnoea	6(14.6)	9(22.0)	0(0.0)	0(0.0)	0(0.0)	3(7.3)	18(43.9)	<.001

**4. DISCUSSION**

In this study acute poisoning constituted 0.68% of the total admission to the EPU. This figure is lower than those reported in another part of North Eastern Nigeria and in the North Central region (0.74% and 0.94% respectively) [4,11].

The figures from Southern Nigeria are however lower than was obtained in the current study. A prevalence of 0.52% was recorded at Ile Ife in the country's South West and 0.43% at Enugu, South Eastern Nigeria [5,6]. A comparison with studies from some other developing countries shows higher prevalence figures from Iran and Turkey; 6.3% and 2.31% respectively [15,16]. In Qatar 0.22% of all accident and emergency admissions are managed for acute poisoning [17]. Developed countries in Europe and North America generally show lower prevalence rates than what is demonstrated in this study [1,18]. The absence of coordinated preventive strategies bordering on packaging legislations in Nigeria may account for the high prevalence in the present study. Another likely contributor to the high figures in our setting is the prevailing poor state of housing. Most homes are crowded and inhabited by large families making supervision of active children challenging.

More boys were affected than girls in this review which is consistent with the majority of studies [4-7,19,20]. This may be a consequence of the more curious and daring nature of boys. Furthermore, in our locale there is generally less family watchfulness of the boy child particularly beyond the age of 5 years. This usually affords the boys more freedom to act without adult oversight. Nonetheless, a few reports have suggested that girls are more likely to be affected by acute poisoning [11,16]. The mortality rate derived from this study compares favourably with most other Nigerian figures [5,6,11]. The fact that

kerosene poisoning which is more likely to cause death did not feature as the commonest poison agent in this study may account for this discrepancy. Moreover, the health seeking behaviour in our setting is unsatisfactory so many cases of childhood poisoning may not have presented to our facility [21]. The mortality rate in the present study is however, higher than that reported from Maiduguri, North East Nigeria. Every single one of the subjects in the current study individually (accidentally) ingested the poisonous substance, mostly at home and a significant majority presented to the hospital within 6 hours after the event. This is similar to findings from other studies [4-6,8,11,16].

Our results show that a child affected by acute poisoning and presenting with convulsions is most likely to have ingested organophosphates. This is not at variance with findings from other studies [22,23]. Organophosphates are basically anticholinesterases, meaning that they block the action of acetyl cholinesterase hence potentiating uninhibited acetylcholine action in various organs and tissues with associated increase in parasympathetic activity [24]. Seizures, coma and shock are frequently part of the clinical features in severe cases [22,23]. The clinical features most likely indicative of kerosene poisoning include cough, dyspnoea and tachypnoea. This is in keeping with the current body of knowledge [25,26]. Kerosene is a hydrocarbon. Its harmfulness is determined by its content of naphthenic and aromatic hydrocarbons. It is effortlessly aspirated and may cause aspiration pneumonitis. In addition, neural tissue which is rich in the lipid myelin is acted upon by kerosene causing central nervous system depression and suppression of the respiratory drive. For these reasons the manifestations of kerosene poisoning are mainly pulmonary [25,26]. Caustic soda poisoning is significantly associated with dysphagia, drooling and oropharyngeal ulceration. This is in

**Table 4. Association of poison agents with outcome**

Agent	Outcome			
	Discharged(%)	Referred(%)	Death(%)	Total (%)
Organophosphate	17(41.5)	0(0.0)	0(0.0)	17(41.5)
Kerosene	9(22.0)	0(0.0)	1(2.4)	10(24.4)
Medicine	5(12.2)	0(0.0)	0(0.0)	5(12.2)
Caustic soda	2(4.9)	2(4.9)	0(0.0)	4(9.8)
Wild seed	1(2.4)	0(0.0)	0(0.0)	1(2.4)
Rodenticide	4(2.4)	0(0.0)	0(0.0)	4(9.8)
Total	38(92.7)	2(4.9)	1(2.4)	41(100.0)

$\chi^2 = 22.55, df = 10, P = .01$

agreement with previous findings [27,28]. Caustic soda principally contains sodium hydroxide which at pH > 12 can cause burns often affecting the oral cavity, pharynx, larynx, oesophagus and stomach when ingested. Strictures with inability to swallow may follow [27-29].

Contrary to reports from most parts of Nigeria, organophosphates featured as the commonest agent of poisoning in this study [4-6,12,13]. The reason for this deviation from the norm is not immediately apparent. Nevertheless, it may be explained by the fact that our host communities are mainly semiurban/ rural and as such primarily agrarian. Hence the wide spread use of organophosphates as insecticides and pesticides. The referenced Nigerian studies were conducted in cities with minimal agricultural populations [4-6,12,13]. However, a study conducted in a neighbouring state with similar characteristics found organophosphates to be the commonest agent of poisoning amongst children [11]. Organophosphates are also the most frequent agents of poisoning in parts of Egypt and India [9,19].

Kerosene is regarded as the single most widespread paediatric poison agent in Nigeria, Ghana, South Africa, Trinidad, Pakistan as well as many other developing cultures [4-6, 10,12,13,20,31]. It was the second most encountered agent in this study but occurred frequently enough to be regarded as common in Azare. Kerosene is a common household fuel used for cooking and lighting in most parts of Nigeria. It is often sold in unlabelled containers and stored in used soft drink and water bottles making it accessible and attractive to the exploring child. Medications also constituted common poison agents in the present study. The two medicines ingested are ferrous sulphate and carbamazepine tablets. This is similar to findings in other parts of Nigeria [6,11]. Nigeria Lacks legislations on child-resistant packaging of prescription medications, thus children are constantly at risk of poisoning from these agents in the home environment. Caustic soda, rodenticides and seeds of wild plants are the other agents identified in this study. However, kerosene poisoning was most likely to cause death as demonstrated in previous studies [4-6, 19,20].

The current study was retrospective in design with findings dependent on the quality of medical records. In addition, it was conducted in a reference hospital and hence may not be fully

representative of the true status of acute childhood poisoning in our communities. The sample size was also relatively small given that the duration of study spanned a period of 5 years. These constituted its limitations. However, the findings have provided an outline of the clinical profile of paediatric acute poisoning in Azare, North Eastern Nigeria and also added to the available literature on the subject in Nigeria.

## **5. CONCLUSION**

Paediatric acute poisoning is more common in Azare than in most other parts of Nigeria. There is also some dissimilarity in the order of poison agents with organophosphate poisoning being the most frequent in Azare. Kerosene was the most likely to cause mortality. We propose the institution of educational and preventive programmes at the level of government. These would include the enactment of legislations to ensure regulation of packaging of pharmaceutical and non-pharmaceutical agents commonly found in our homes. We also suggest a strict enforcement of child-resistant packaging conditions as well as establishment of poison control centres as strategies for mitigating the morbidity and mortality of acute poisoning in children.

## **CONSENT**

It is not applicable.

## **ETHICAL APPROVAL**

Approval was sought and obtained from the research ethics committee of the Federal Medical Centre Azare, Bauchi state, Nigeria before commencement of the study.

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## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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