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Original Research Article

Chemical Poisoning: Prevalence, Knowledge, and Management of Commonly Encountered Types among Selected Adult Population

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Abstract: Chemical poisoning is a threat to the health of both children and adults in the Niger Delta region. Nevertheless, the study of the prevalence of poisoning has been undermined in Bayelsa state. Chemical poisoning remains an important health concern in Nigeria, especially in the south-south Niger Delta states which are rich in natural fuel. Information on the prevalence in the Niger Delta region is quite scarce, especially in Bayelsa state. The study investigated the risk factors, awareness, and perception of chemical poisoning, and the prevalence among residents of Amassoma and Yenagoa. A descriptive research employed systematic random sampling of 400 residents from Amassoma and Yenagoa from ages 15 years and above, by administering questionnaires and, collecting data. Data were analyzed using SPSS software utilizing ANOVA. The percentage of awareness of chemical poisoning is 28.4% and the majority of the respondents are educated at the tertiary level with a percentage of 51.5%. The female gender was more with a percentage of 51.0%. Among the signs and symptoms of chemical poisoning, nausea or stomach upset has a percentage of 74.6% being the highest percentage, and stomach cramps have a percentage of 72.9% while having a percentage of 56.7%. About 95.5% of respondents concurred to contacting qualified healthcare providers when poisoning is suspected and 93.8% agreed to keep all chemicals out of reach of children as a preventive measure. It can be concluded that the overall prevalence of chemical poisoning is quite low though used intentionally in young adults for suicide. It can also be said that there is proper awareness of the preventive measures for unintentional poisoning.

Keywords: Awareness, Knowledge, Prevalence, Management, Chemical, Poisoning.

INTRODUCTION

Poisons are substances that can cause temporary or permanent damage if too much is absorbed by the body. Poisoning is a condition or process in which an organism becomes chemically harmed severely (poisoned) by an animal's toxic substance or venom (Müller, & Desel, 2013). The safety of a chemical is defined as the therapeutic index or ratio, which is LD_{50}/ED_{50}, (Lachenmeier, & Rehm, 2015, Tamargo *et al*., 2015). Acute poisoning is exposure to a poison on one occasion or during a short period. Toxicity and poisoning can be caused by less dangerous substances than those legally classified as poison (Owais & Khan, 2015; Dai *et al*., 2022). Chronic poisoning is long-term repeated or continuous exposure to a poison where symptoms do not occur immediately or after each exposure but bioaccumulate, or are biomagnified with toxicants such as mercury, gadolinium, and lead, (Tetsuka *et al*., 2021). General signs and symptoms of poisoning include nausea or stomach upset, respiratory depression, difficulty swallowing, hypersalivation/ drooling, dehydration, seizures/convulsion, nasal bleeding, loss of appetite, bloody stool, dizziness, blurred vision, sweating, diarrhea, increased thirst, mild to severe headache, fatigue, minor skin or eye irritation,

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confusion and disorientation, stiffness in the joints, (Flomenbaum *et al.*, 2006; Boyle *et al.*, 2009; Holstege *et al*., 2008; CDC, 2024). Major routes of poison ingestion include oral ingestion, parenteral, subcutaneous, and inhalational (Lawrence *et al.*, 2007).

Agents that act on the nervous system can paralyze in seconds or less and include both biologically derived neurotoxins and so-called nerve gases, which may be synthesized for warfare or industry (Khan *et al*., 2015). Most biocides, including pesticides, are created to act as poisons to target organisms, although acute or less observable chronic poisoning can also occur in non-target organisms (secondary poisoning), including the humans who apply the biocides and other beneficial organisms (Jones, & Joshi, 2021; Butucel *et al*., 2022). In mild poisoning, the patient sleeps, hard to wake up, but falls asleep rapidly, while moderate poisoning is associated with coma, hypo-areflexia, narrow pupils, pulsus filiformis, hypotension, sweating, lacrimation, after 1-2 hours bullas and decubitus (Gallagher, & Edwards, 2019; Parris *et al*., 2022). For severe poisoning, the patient experiences coma, total areflexia, dilated, reflecting pupils, breathing is frequent, but not deep, pulsus filiformis, pulmonary edema, breathing arrest, and death due to aspiration, occlusion of the airways (Chandran & Krishna, 2019).

Chemical poisoning is illnesses that result from the intentional or unintentional release of a toxicant into the environment, which may be in the form of liquid, solid, gas, or vapor fumes (Müller, & Desel, 2013; Boedeker *et al*., 2020). Agricultural (insecticides, herbicides, fungicides, fumigants, and rodenticides), industrial chemicals, and drugs, are all forms of chemical poisoning (*Webley et al., 1997;* Zaheer *et al.*, 2009). Inorganic compounds like manganese, lead, cadmium, nickel, arsenic compounds, beryllium oxide, and mercury are all potential toxicants (*Curtis et al., 2016; Bunu et al., 2023; Bunu et al., 2023a*). There is also food poisoning resulting from contaminated food by pathogenic bacteria, viruses, parasites, or toxins (poisonous mushrooms) (*Patel et al., 2023*).

Initial management for all poisonings includes ensuring adequate cardiopulmonary function and providing treatment for any symptoms such as seizures, shock, and pain (Erickson *et al*., 2007). In the majority of poisonings, the mainstay of management is providing supportive care for the patient (Al-Jelaify, & AlHomidah, 2021). Treatment of a recently ingested poison may involve gastric decontamination with activated charcoal, gastric lavage, whole bowel irrigation, or nasogastric aspiration to decrease absorption (Chyka *et al.*, 2005; Houston *et al.*, 2005). Cathartics were postulated to decrease absorption by increasing the expulsion of the poison from the gastrointestinal tract (AAC, 2004). Nasogastric aspiration is used for liquid ingestions where activated charcoal is ineffective, e.g. ethylene glycol poisoning (Vale *et al*., 2004). Whole bowel irrigation cleanses the bowel majorly used to treat ingestion of sustained-release drugs, toxins not absorbed by activated charcoal (e.g., lithium, iron), and for removal of ingested drug packets (WBI, 2004). In some situations, the elimination of the poison can be enhanced with diuresis, hemodialysis, hemoperfusion, hyperbaric medicine, peritoneal dialysis, exchange transfusion, or chelation (Chyka *et al*., 1999; Moll *et al.*, 1999).

Poisoning can be adequately prevented through proper professional public enlightenment, advocacy, and education (Miediegha, & Bunu, 2020; Bunu *et al*., 2021). Proper hand-washing with disinfectants after contact with chemicals, keeping all chemicals, as well as drugs out of reach of children, identifying toxic chemicals in the home and removing them, following safe and proper handling recommendations for all foods and chemicals, proper disposal of poisonous waste products (Peden *et al*., 2008; WHO, 2019). Also, not perceiving a container to identify its content, ensuring proper disposal of the empty containers of used household chemicals, ensuring proper ventilation when using chemicals, proper labeling of poison containers, avoiding the use of containers meant for beverages at homes for storing household chemicals, etc., (Daly *et al.*, 2006; Wu *et al*., 2023). The current study aimed to determine the prevalence, commonly encountered type of poisoning, and the knowledge of proper poisoning management among Amassoma and Yenagoa Residents.

METHOD

Study Setting and Design

The descriptive research project was conducted in the Amassoma community in the Southern Ijaw LGA and Yenagoa in the Yenagoa LGA of Bayelsa state. This is a non-experimental descriptive research project conducted to understand the risk factors for chemical poisoning and its prevalence in the study areas to generate the basis for effective intervention in preventing and managing poisoning. The inclusion criteria in the target population were all adults ≥15 years of age. A systematic random sampling method was employed. Sample sizes of 400 participants were randomly selected, they consented and confidentiality was assured. The research was approved by the research and ethics committee of the Faculty of Pharmacy, Niger Delta University, Nigeria.

Data Collection and Analysis

The data collection was done using a study questionnaire that was divided into five sections; A (demographic data), B (awareness level), C (signs and symptoms of chemical poisoning), D (management of poisoning), and section E (preventive measures of poisoning), respectively. The questionnaires were distributed to the target population for response according to their understanding, after which the questionnaires were retrieved. The data obtained was

analyzed using descriptive statistics on SPSS software utilizing ANOVA.

RESULT

The demographic data revealed respondents within the ages of (26-30) to have the highest frequency (105) with a percentage of (26.1%). The gender of the respondents with the highest frequency (205) and a percentage (51.5%) were female. The married proportion was more with a percentage a proportion of 41.5% (165).

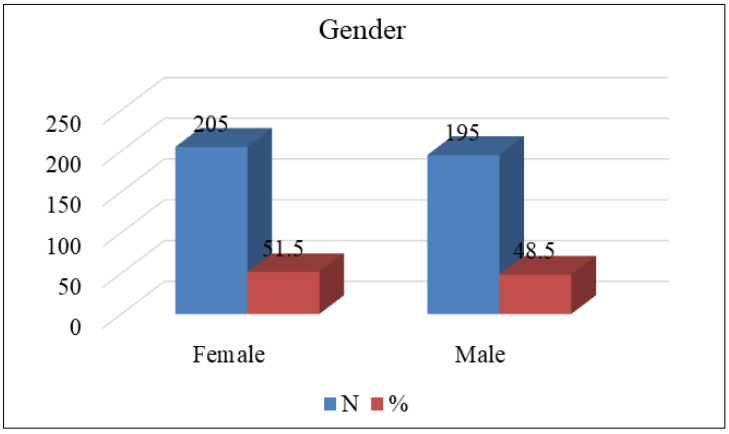

Figure 1: Gender of Participants (N= Frequency, % = Percentage).

Table 1: Demographic data

Variables		**Frequency (N)**	**Percentage (%)**
Age (years)	15-20	25	6.2
	21-25	65	16.2
	26-30	105	26.1
	31-35	92	22.9
	36-40	56	13.9
	41-45	20	5.0
	46-50	25	6.2
	>51	10	2.5
Marital status	Single	165	41.5
	Married	190	47.3
	Divorce/Separated	34	8.5
	Widow	10	2.5
Occupation	Student	96	23.9
	Housewife	59	14.7
	Employed	128	31.8
	Retired	3	0.7
	Others	112	27.9
Education	Primary	31	7.7
	Secondary	162	40.3
	Tertiary	207	51.5
State of origin	Bayelsa	195	48.5
	Delta	95	23.6
	Rivers	27	6.7
	Akwa Ibom	10	2.5
	Edo	21	5.2
	Cross River	1	0.2
	Others	46	11.4
Ethnicity	Ijaw	318	79.1
	Igbo	34	8.5
	Hausa	1	0.2
	Yoruba	11	2.7
	Others	33	8.2

Awareness among the respondents of poisoning was very high (85.1%). The frequency (222) of those who have read about poisoning was 55.3%. The dominating source of information on poisoning was TV/radio/internet with a frequency of 266 and a percentage of 66.1%. More than 10.0% claimed to have had an encounter with poison in the past.

Table 2: Awareness of Poisoning

Variables			**Yes N (%)**		**No N (%)**	**Don't Remember N (%)**
Knowledge on Poisoning	Heard about poisoning		345(85.1)		54(13.4)	1(0.2)
	Read about poisoning		222(43.2)		173(55.2)	4(1.0)
	Encountered poison		43(10.7)		357(89.3)	-
Source of information						
TV/Radio/Internet	Newspaper/Magazine		Seminar/Conference		School lecture	Others
266(66.1)	10(2.5)		5(1.2)		47(11.4)	72(17.6)
Nature of poisoning						
Food	Chemical/Insecticide		Drugs		Fish	Herbal Products
196(48.7)	114(28.4)		40(10.0)		12(3.0)	36(9.0)
	Insecticides	Medicines	Detergents/ Disinfectants	Natural fuel	Alcohol	Rat poison
Chemicals used at home	133(39.6)	3(0.7)	69(17.2)	108(26.9)	10(2.5)	77(19.2)
Frequently used chemicals	39(9.7)	-	86(21.4)	238(59.2)	16(4.0)	21(5.2)
How often chemicals are used						
	Daily		Weekly		Monthly	Others
	332(82.6)		63(15.7)		2(0.5)	1(0.2)

Table 2 shows some various signs and symptoms manifest in different types of poisoning. Nausea or stomach upset 74.6% (302), difficulty breathing 56.7% (228), and stomach cramps 72.9% (293) are the most observed signs and symptoms.

Table 3: Signs and Symptoms of Poisoning

Variables	**Statistical Parameters**				
	SA N (%)	**A N (%)**	**N N (%)**	**D N (%)**	**SD N (%)**
Behavioral changes	146(36.3)	165(41.0)	74 (18.4)	11(2.7)	2(5)
Diarrhea	138(34.3)	152(37.8)	92(22.9)	13(3.2)	0
Dizziness	131(32.6)	222(55.2)	44(10.9)	1(2)	-
Drowsiness	92(22.9)	241(60.0)	63(15.7)	4(1.0)	-
Fatigue	144(35.8)	177(44.0)	71(17.7)	2(0.5)	-
Headache	128(31.6)	208(51.7)	62(15.4)	2(0.2)	-
Loss of appetite	213(53.0)	141(34.8)	36(8.7)	6(1.5)	1(0.2)
Minor skin or eye irritation	39(9.7)	97(24.1)	173(43.0)	65(16.2)	20(5.0)
Nausea or Stomach upset	302(74.6)	87(21.6)	8(2.0)	3(1.7)	-
Frequent cough	61(15.2)	214(53.2)	112(27.9)	8(2.0)	1(0.2)
Soreness or stiffness in the joint	12(3.0)	65(16.2)	152(37.8)	124(30.8)	44(10.9)
Thirst	45(11.2)	100(24.9)	153(38.1)	95(23.6)	-
Blurred Vision	29(7.2)	168(41.8)	166(41.3)	35(8.7)	1(0.2)
Confusion and Disorientation	35(8.7)	118(29.4)	203(50.5)	37(9.2)	1(0.2)
Difficulty Breathing	68(16.9)	228(56.7)	102(25.4)	2(0.5)	-
Sweating	95(23.6)	114(28.4)	150(37.3)	35(8.7)	-
Stomach Cramps	293(72.9)	94(23.4)	4(1.0)	4(1.0)	0
Bloody Stool	163(40.5)	156(38.8)	56(13.9)	19(4.7)	2(0.5)

SA - Strongly Agree, A - Agree, N – Neutral, D - Disagree, SD – Strongly Disagree

In preventing poisoning, 93.8% (377) of respondents strongly agreed to keep chemicals out of reach of children. It is the variable with the highest percentage (%).

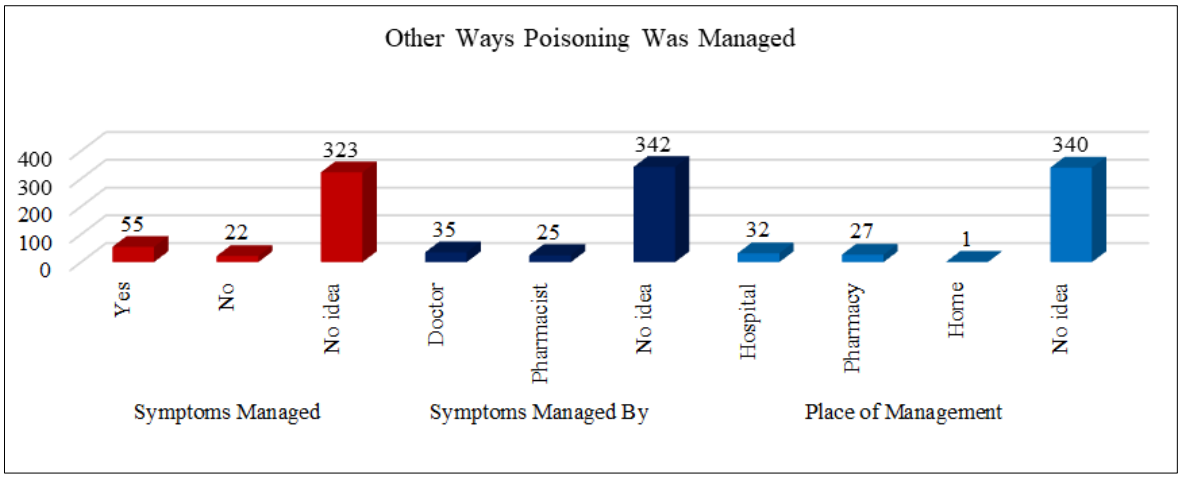

Figure 2: Other ways utilized in the Management of Poisoning Symptoms.

Table 5: Prevention of Poisoning

Variables	Statistical Parameters				
	SA N (%)	A N (%)	N N (%)	D N (%)	SD N (%)
Contact Qualified Healthcare Provider	384(95.5)	15(3.7)	-	-	-
Identify and Remove Toxic Chemicals from Home	287(71.4)	96(23.9)	14(3.5)	-	-
Keeping Chemicals out of the reach of children	377(93.8)	18(4.5)	-	1(0.2)	-
Safe handling of foods and chemicals	238(59.2)	157(39.1)	-	-	1(0.2)
Proper hand washing with disinfectants after contact	270(67.2)	127(31.6)	1(0.2)	-	-
Proper disposal of poison containers	236(58.7)	159(39.6)	2(0.5)	-	-
Not Perceiving containers before use	184(45.8)	91(22.6)	95(23.6)	27(6.7)	-
Proper disposal of poisonous wastes	263(65.4)	134(33.3)	2(0.5)	-	-
Proper use of containers at home	265(65.9)	123(30.6)	8(2.0)	1(0.2)	1(0.2)
Good ventilation	189(47.0)	161(40.0)	33(8.2)	13(3.2)	-
Proper Education	322(80.1)	74(18.4)	1(0.2)	-	-

SA - Strongly Agree, A - Agree, N – Neutral, D - Disagree, SD – Strongly Disagree

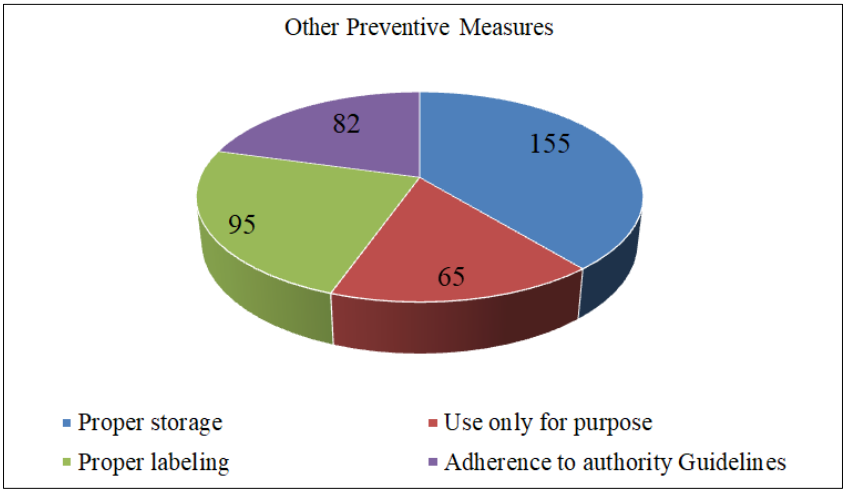

Figure 3: Other preventive measures

DISCUSSION

About 85.1% (342) of the target population are aware of poisoning and the source of their information is TV/radio/internet at a percentage of 52.5% (210). The awareness of the respondents on chemical poisoning has a percentage of 28.4% (114). Among the chemicals used by the target population, insecticide has the highest

percentage of 32.6% (131). This explains why the use of insecticides such as sniper (2,2-dichloromethyl divinyl phosphate) has been a commonly assessable suicidal agent because of its frequent use which accounts for 9.2% (37). Natural fuels are the most frequently used chemicals with a percentage of 59.2% (238) and a percentage of 26.9% (108) among the chemicals used at home though poisoning with natural fuel is more common in children under the age of 5 years. Chemicals such as Sniper, an insecticide, and paraquat (dimethyl 4-4 bipyridine) an herbicide are used commonly in young adults (18-28) for intentional poisoning (suicide) due to emotional problems such as depression, mood swings, relationship jilt, academic failure, etc., (Huang *et al*., 2019)

About 10.7% (43) of either the target population or their relatives have encountered chemical or drug poisoning. Amongst the signs and symptoms of chemical poisoning, stomach upset or nausea has the highest percentage of 74.6% (302) been the highest, stomach cramps have a percentage of 72.9% (293) while difficulty breathing has a percentage of 56.7% (228). This implies that the variables are primary signs and symptoms of chemical poisoning. The percentage of managed poison cases is 13.7% (55) while the invalid percentage is 80.3% (323) and could consist of deaths that occurred from chemical poisoning which were not recorded and a target population that has neither experienced nor seen any case of chemical poisoning but are aware of chemical poisoning thus they cannot confirm whether chemically poisoned cases were properly managed. Contacting a qualified health care provider is the preventive measure with the highest percentage of 95.5% (384) while keeping chemicals out of reach of children has a percentage of 93.8% (377) as children are prone to poisoning due to their explorative attitude of always putting objects into their mouth. Proper education on poisoning ranked third with a percentage of 80.1% (322).

CONCLUSION

According to the thorough study, the general rate of chemical poisoning is fairly low among the studied population, despite its intended use in young adults for suicide. Adequate and well-designed public education, advocacy, and understanding of preventive measures for unintentional poisoning are required to avoid potentially fatal occurrences of chemical poisoning in these populations.

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