



Pattern of food, drug and chemical poisoning in Qassim region, Saudi Arabia from January 2017 to December 2017

Sulaiman Alnasser^{a,*}, Shalam M. Hussain^a, Ibrahim M Alnughaymishi^b, Abdullah M Alnuqaydan^c

^a Department of Pharmacology and Toxicology, Unaizah College of Pharmacy, Qassim University, Saudi Arabia

^b Department of Environmental and Occupational Health, Ministry of Health, Saudi Arabia

^c Department of Medical Biotechnology, College of Applied Medical Sciences, Qassim University, Saudi Arabia

ARTICLE INFO

Keywords:

Acute poisoning
Analgesic intoxication
Accidental poisoning
Household exposure
Insecticides
Qassim region.

ABSTRACT

Background: Poisoning has become a widespread and dangerous phenomenon worldwide. The purpose of our study was to determine and analyze the pattern of poisoning cases induced with food, drugs, and chemicals reported to the Department of Environmental and Occupational Health in Qassim province in the Kingdom of Saudi Arabia. The study also evaluated the correlation of demographic variables such as age, type of toxicity and geographical distribution associated with poisoning in Qassim province.

Methods: This retrospective cross-sectional study was performed on 381 cases of poisoning. The data was collected from Jan 2017 to Dec 2017 and revealed that out of 381 cases, 120 have food poisoning (65 % females and 35 % males), 180 have drug poisoning (55.56 % females and 44.44 % males), whereas 81 cases have chemical poisoning (41.98 % female and 58.02 % male). Data were statistically analyzed using SPSS/PC statistical package. The study revealed that the most common agents involved in acute poisoning were drugs (47.25 %), especially analgesics such as Paracetamol (Acetaminophen), followed by antipsychotic drugs. Food poisoning was the second acute poisoning with (31.40 %). Finally, chemical poisoning involved in acute poisoning with 21.20 % of cases reported household products accomplished strongest bleach (chlorines)(Clorox®) and insecticides were the secondary source for chemical poisoning.

1. Introduction

The use of food, chemicals, and medicines has increased the chances of poisoning in the past few decades throughout the world, especially Saudi Arabia, due to considerable growth in agriculture, chemical and pharmaceutical industries. Food poisoning is also referred to as food-borne illness results by consuming unhealthy or contaminated food [1]. The outbreak of food poisoning is related to catering forms, whether the food is eaten in situ or bought for later consumption [2]. On the other hand, drug and chemical poisoning are either by group or individually or both of the orally or intravenously use of a drug or chemicals in higher amounts lead to poisoning or may lead to death [3]. Food-borne infections are common worldwide. Amongst the issues responsible for this burden are centralization and globalization of food supply, growing microbial resistance to antibiotics, and the progress of immunosuppressed subpopulations [4,5].

Actually, laboratory-based reporting systems do not really represent

the real burden of disease in the population. However, they have still considered the most reliable indicators of food poisoning, particularly in countries with a good surveillance mechanism based on the highest quality standards like the United Kingdom (UK) and United States of America (USA) [1]. Commonly foods related to food poisoning are eggs, meats, poultry, unpasteurized milk or other fluids, cheese, raw fruits and usually unwashed vegetables, nuts, and spices [6,7]. In 1984, a national policy for reporting, notifying, and recording bacterial food poisoning incidents was established in Saudi Arabia [8]. Moreover, since then, food poisoning outbreaks have been reported from different regions worldwide, exhibiting seasonal and regional variations, and this associated with mass catering is not uncommon [8] and has been reported even from developed countries [9]. Acute poisoning directly associated with road traffic accidents is the second-largest morbidity world cause [10]. Despite food poisoning, drug and chemical poisoning patterns vary among the developing countries [11,12]. World over, particularly in Asia, the cause of poisoning may be influenced by socioeconomic and

* Corresponding author.

E-mail address: sm.alnasser@qu.edu.sa (S. Alnasser).

<https://doi.org/10.1016/j.toxrep.2020.10.009>

Received 18 December 2019; Received in revised form 2 October 2020; Accepted 12 October 2020

Available online 15 October 2020

2214-7500/© 2020 The Author(s).

Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

cultural influences as well as religious factors [13]. The majority of drug and chemical poisoning are categorized as an immediate risk to health, life, property, or environment and is more common in young males and females. Most of these poisonings require urgent intervention to prevent a worsening of the situation, especially those mainly contributed by self-poisoning with insecticides and corrosives [14]. Many drugs are represented as similar poisonous in higher concentrations or dosages [15,16]. However, it mainly different in the management and the type of antidote. Chemical substances are widely used in the medical, farming, and manufacturing fields [17]. Chemical poisoning is one of the major causes of admission to emergency rooms and hospitalization as in cases of mortality in developed and developing countries [18,19]. Many studies have exposed different factors that can affect the incidence of chemical poisoning and mortality, including nature, age and amount of poison, administration route, and other factors [20–24]. In particular, the total reported several cases of acute chemical poisoning in the Qassim region were 404 from April 1999–February 2003. Studies of the pattern of chemical poisoning have been shown in many cities in Saudi Arabia, including Riyadh, Qassim, Najran, Makkah and Jeddah; moreover, all of these studies have shown different age group among children or adults with other different factors [25,26]. In this study, we aim to evaluate the pattern of acute food, drug, and chemical poisoning in both adults and children in Qassim province of Saudi Arabia, at a referral Department of Environmental and Occupational Health, Ministry of Health, Qassim, Saudi Arabia, between January 2017 and December 2017, for one year.

2. Materials and methods

This retrospective study was performed on 381 cases of poisoning (including food, drugs and chemicals) 120,180 and 81 cases retrospectively, which were recorded during one year (Jan-2017-Dec-2017). A study was carried out in Qassim Province, Kingdom of Saudi Arabia. The total population of the region during the year 2017 was approximately 1,370,727. Patient data relevant to the study obtained and recorded from the Department of Environmental and Occupational Health, Ministry of Health, Qassim, Saudi Arabia.

2.1. Data collection and analysis

Data was collected using a semi-structured datasheet from patients' records containing different socio-demographic variables with the outcome as the endpoint. Patients' demographic and outcome data were grouped into various categories. Counts and percentages were tabulated to determine the characteristics of poisoning to assess the distribution of each characteristic. The statistical analysis was done using the SPSS software package for Windows, version 20, Chicago, USA.

3. Results

3.1. Characteristics of cases of food poisoning in Qassim region

From January 2017 to December 2017, 120 food poisoning reported 381 cases to the Department of Environmental and Occupational Health in the Ministry of Health, Alqassim, KSA. Based on the report, drug poisoning made up the major proportion of poisoning-related admissions (47%) followed by food poisoning (32%) and chemical poisoning (21%). Based on the geographic distribution of the cities in the Qassim region, the city of Thuryah coming as the highest rates of food poisoning with 35 subjects (29.17%), followed by 18 (15.00%) in Uglat Alssu-goor. The incidence rate of food poisoning in Unizah, Buridah, Araas, Alasyaah, Duknah, Tal Rasheed, Gubah and Almethnab has 15 (12.50%), 13 (10.83%), 13 (10.83%), 9 (7.50%), 5 (4.17%), 5 (4.17%), 4 (3.33%) and 3 (2.50%) respectively. However, 10 (44.44%) poisoning associated food-borne diseases were reported at home, whereas 8 (44.44%) subjects are reported from the restaurant (Table 1). Additionally,

Table 1

Characteristics of cases of food poisoning in Qassim region.

City	N			%
Buridah	13			10.83
Tal Rasheed	5			4.17
Unizah	15			12.50
Gubah	4			3.33
Alasyaah	9			7.50
Duknah	5			4.17
Araas	13			10.83
Thuryah	35			29.17
Uglat Alssu-goor	18			15.00
Almethnab	3			2.50
Total	120			100.00
Places of food borne diseases				
Home	10			55.56
Restaurant	8			44.44
Total	18			100.00
Age Group				
	Number of			
	Males	Females		
Less than one year	1	0	0.83	
1–4 years	2	4	5.00	
5–19 years	18	19	30.83	
20–49 years	19	51	58.33	
Over 50 years	2	4	5.00	
Total	42	78	100.00	
	42 + 78 = 120			
Year of cases reported				
2017	120			25.21
2016	20			4.20
2015	84			17.65
2014	42			8.82
2013	34			7.14
2012	45			9.45
2011	41			8.61
2010	8			1.68
2009	12			2.52
2008	15			3.15
2007	24			5.04
2006	31			6.51
Total	476			100.00

only one case of food poisoning from a Saudi infant was reported in the study, however, there was the non-report of food poisoning from non-Saudi. Further, the data analysis revealed that the highest percentage of poisoning were observed of females (51 cases), whereas 19 cases of males of 20–49 years of age group, followed by 19 female and 18 male cases of 5–19 years of age group, 4 females and 2 male cases of 1–4 years of age group and lastly 4 females and 2 male poisoning cases of over 50 years of age group were recorded. According to the report of food poisoning from 2006 to 2017, the highest poisoning was documented in current study 120 (25.21%), followed by in 2015, 84 (17.65%), 2012 (9.45%), 2014 (8.82%), 2011 (8.61%), 2013 (7.14%), 20,066.51%, 2007 (5.04%), 2016 (4.20%), 2008 (3.15%), and 2010 (1.68) (Table 1).

3.2. Characteristics of cases of drug poisoning incidence in Qassim province

In the present study, the incidence rate of drug poisoning in females was 100 (55.56%), while males were 80 (44.44%). A significant proportion of 166 (92.22%) belongs to the Saudi nationality, and 14 (7.78%) of the patients of drug poisoning were non-Saudis. Around 156 (86.67%) subjects had accidental poisoning compared to 22 (12.22%) intentional and 2 (1.11%) cases have recorded unknown history. Children patients aged 1–5 years were the highest percentage with 126 patients (70.00%) compared to the 2 (1.11%), 8 (4.44%), 17 (9.44%), 22 (12.22%) and 5 (2.78%) for age groups (less than one year), (6–12 years), (13–19 years), (20–39 years) and (over 40 years) respectively

Table 2
Characteristics of cases of drug poisoning incident in Qassim region.

Gender	N	%
Male	80	44.44
Female	100	55.56
Total	180	100
Nationality		
Saudi	166	92.22
Non- Saudi	14	7.78
Total	180	100
Type of exposure		
Accidental	156	86.67
Intentional	22	12.22
Unknown	2	1.11
Total	180	100.00
Age groups		
Less than one year	2	1.11
1–5 years	126	70.00
6–12 years	8	4.44
13–19 years	17	9.44
20–39 years	22	12.22
Over 40 years	5	2.78
Total	180	100

(Table 2). Based on Pharmaceutical poisoning, the majority of poisoning cases were Analgesic 54 (33.00 %), antipsychotic 20 (12.00 %) and antidiabetic19 (12.00 %) are coming as the second common cause of drug poisoning followed by asthma medication were 15 (9.00 %) and antihistamine was 15(9.00 %) (Fig. 1).

3.3. Characteristics of cases of chemicals poisoning incident in Qassim region

Despite having a significant number of cases associated with food and drug poisoning, a good number of chemical poisoning cases have been recorded. The current study revealed that more than 47 (58.02 %) cases of males have poisoning due to chemical agents. However 49 (60.49 %) cases of children aged 1–5 years were admitted with the indication of chemical poisoning. Furthermore, the majority of cases 71 (87.65 %) were Saudi citizens. Also, in 76 cases (93.83 %), the

Table 3
Characteristics of cases of chemicals poisoning incident in Qassim region.

Gender	N	%
Male	47	58.02
Female	34	41.98
Nationality		
Saudi	71	87.65
Non- Saudi	10	12.35
Types of exposure		
Accidental	76	93.83
Intentional	3	3.70
Unknown	2	2.47
Age groups		
Less than one year	4	4.94
1–5 years	49	60.49
6–12 years	4	4.94
13–19 years	2	2.47
20–39 years	19	23.46
Over 40 years	3	3.70
Total	81	100

accidental poisoning was reported, and in 3 cases (3.70 %) was intentional (Table 3). In specific, Clorox was the most common 21 (25.90 %) type of household products implicated in chemical poisoning, followed by insecticide and detergents 11 (13.60 %). (Fig. 2).

3.4. Antidotes used in the therapy, the routes of Exposure and Place of Incidence drugs and chemicals poisoning

In patients with both drugs and chemicals poisoning activated charcoal (AC) was the most commonly used antidote, then oxygen and N-Acetylcystine for (104, 6 and 4 patients respectively) (89.66 %,5.17 % and 3.45 % respectively) (Table 4). A total of 261 patients were exposed to drugs and chemicals with poisoning. As shown in Table 4, the route of poisoning was oral in most cases (93.49 %) compared to 6.51 % was inhalation. On the other hand, the home was the majority of the place Incidence of poisoning with 251 cases (96.20 %) followed by farm and Workplace 5(1.90 %) and 3(1.10 %), respectively.

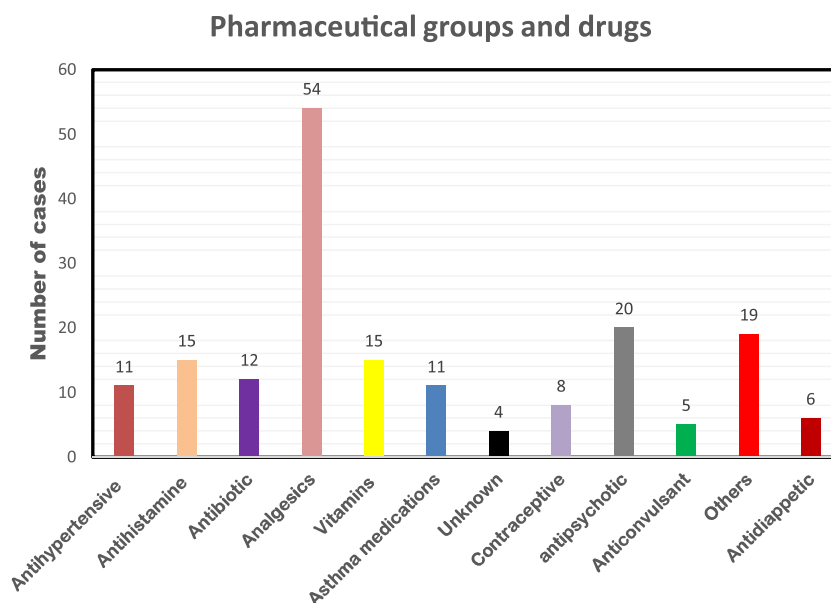


Fig. 1. Distribution of drug poisoning cases based on pharmaceutical groups and drugs.

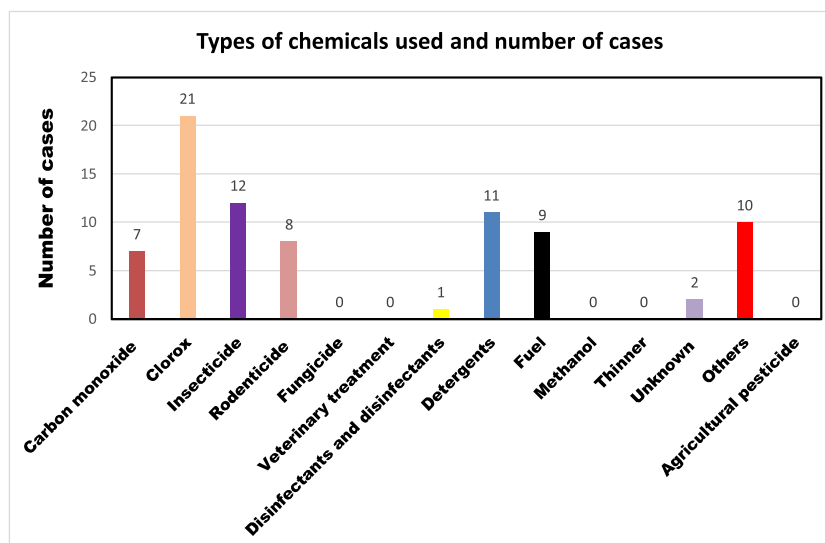


Fig. 2. Distribution of chemicals poisoning cases based on types of chemicals.

Table 4

Antidotes used in the therapy, the routes of Exposure and Place of Incidence drugs and chemicals poisoning.

Antidote Used	N	%
Activated Charcoal	104	89.66
Amyl nitrite	1	0.86
Atropine	1	0.86
N-Acetylcystine	4	3.45
Oxygen	6	5.17
Total	116	100
Routes of Exposure		
Inhalation	17	6.51
Oral	244	93.49
Total	261	100

4. Discussion

Poisoning remains a significant and growing public health threat worldwide, resulting in significant morbidity and mortality, hospital admission, and consumes valuable health service resources [27]. The incidence of food poisoning varies from region to other region and between city to another one. The current study revealed a significant difference in poisoning from one city to another city within the Kingdom of Saudi Arabia. There was no apparent reason but because of the number of restaurants compared to the population. Surprisingly, in the current study, poisoning cases reported from home appears higher than cases reported from restaurants. However, restaurants are a large source of contaminated food and foodborne disease worldwide [28]. The ingested poisons can be classified into food, drugs (prescribed or non-prescribed), household products and plant product derivatives with a variety of toxicity degrees (low, intermediate or highly toxic) [29]. Acute poisoning is one of the most frequent causes of hospital admission and mortality. The present study findings report that the incidence of drug poisoning in females was higher than in males, which is consistent with several studies conducted in Iran and Turkey [27]. Contrary to the study findings, in some other countries reported that males outnumber females [18]. This finding has been reported in other studies in Saudi Arabia indicated that female are more likely to attempt suicide than male and experience drugs poisoning [21]. Furthermore, Children aged less than 5 years old were the most commonly exposed group to drug poisoning which is consistent with findings of Australian and Saudi

studies [30]. Home medications were one reason for children drug poisoning because of its availability over chemist counters and easy to reach storage cabinet [21,25]. Also, the attractive packaging of the medications can play a role in children poisoning by getting children's attention. The findings have shown that most drug poisoning cases occurred among Saudis, which aligns with other Saudi studies [31]. In addition, the motive of the consumption of poison in the majority of cases in the study was accidental. Other studies also show the same trend (29). Contrary to the study findings, suicide was the major case of drug poisoning [18,22,32]. Moreover, the present study findings report that analgesics were the commonest drugs implicated in pharmaceutical drug poisoning, which is consistent with a study in Saudi Arabia [31,32].

On the other hand, the present study findings report that the incidence of chemical poisoning in males was outnumbering females, consistent with an Indian tertiary care hospital [33]. In contrast with our findings, some studies reported that male preponderance had been found in Qassim province, as well as India [26,34]. Furthermore, children aged less than 5 years old were the most commonly exposed age group to chemical poisoning, which is consistent with Saudi studies' findings in Riyadh and Qassim [25,26]. Conflicting to our findings, a recent Indian study was reported that the highest number of chemical poisoning cases occurred among adults aged 21–30 years [18]. Also, the findings have shown that the majority of chemical poisoning cases occurred among Saudis, which is consistent with other Saudi studies [30, 31]. Besides, accidental chemical poisoning has been recorded in several studies consisting of the study findings [35,36]. Interestingly, the present study findings report that accomplished strongest bleach (chlorines) (Clorox®) was the commonest household products implicated in chemical poisoning, which is consistent with a study in Qatar and another study in Jeddah that highlighting a high incidence of chemical poisoning among children [37,38]. Obviously, activated charcoal was the most therapeutic option used in the cases admitted to the hospital in the reported cases (Table 4). As known, activation charcoal can significantly reduce the overall drug absorption when given shortly and works in patients suffering from acute overdose such as organochlorine insecticides and herbicides [39–41]. Moreover, it can be used in gastrointestinal decontamination overdose of drugs and toxins, reducing their absorption [39,42]. The oral route is the most common type of exposure reported in the current study (Table 4), and the possible reason is that patients in the age group of 1–5 years were accidental toxicity of drugs or chemicals were the most cases reported [30,43]. Likewise, food poisoning increased recently because of various food resources such as restaurants and food trucks and lack of awareness in cleaning.

5. Conclusion

This study highlights that there is a significant incidence of food poisoning in the age between 20–49 years were female (51 cases) and 19 for male compared to other age groups. Furthermore, there has been a marked increase in poisoning cases in recent years, where the highest rate in 2017 by 120 cases.

The present study demonstrated that, pharmaceutical and chemical products were identified as the main cause of poisoning in Qassim. In the light of data from the results of this study and literature, the cases were involved females and young children younger than 5 years old. Most cases were accidental not intentional, and the most commonly used drugs were analgesics, followed by psychoactive. Parental awareness should be increased, and educational programs must be provided to the public to prevent the high incidence of poisoning among children and adolescents.

Declaration of Competing Interest

The authors report no declarations of interest.

Acknowledgement

We thank MR. Adel A Aladhadh, Department of Environmental and Occupational Health, Ministry of Health, Saudi Arabia for his assistance in administrative coordination of data collection. We also thank Dr. Adel Abbas from College of Health Sciences, Qassim University, Al-rass for the proof reading of this article.

References

- [1] Y. Al-Mazrou, Food poisoning in Saudi Arabia, *Saudi Med. J.* 25 (2004) 11–14.
- [2] R.M. Rooney, E.H. Cramer, S. Mantha, et al., A review of outbreaks of foodborne disease associated with passenger ships: evidence for risk management, *Public Health Rep.* 119 (2004) 427–434.
- [3] K.R. Olson, I.B. Anderson, N.L. Benowitz, et al., *Poisoning & Drug Overdose*, sixth edition, Lange Medical Books/McGraw-Hill, 2011.
- [4] C. Soussan, K. Sundström, M. Andersson, A. Kjellgren, Poisoning Casualties: Alcohol, Pharmaceuticals or “Legal Highs”? Poisoning Cases at Emergency Rooms in The Swedish County Värmland in 2007–2013, *J. Community Med. Health Educ.* (2015) 5.
- [5] H.I. Kademi, I.A. Baba, F.T. Saad, Modelling the dynamics of toxicity associated with aflatoxins in foods and feeds, *Toxicol. Rep.* 4 (2017) 358–363.
- [6] I.F. Angelillo, N. Viggiani, L. Rizzo, A. Bianco, Food handlers and foodborne diseases: knowledge, attitudes, and reported behavior in Italy, *J. Food Prot.* 63 (2000) 381–385.
- [7] I.N. Tsakiris, M. Goumenou, M.N. Tzatzarakis, et al., Risk assessment for children exposed to DDT residues in various milk types from the Greek market, *Food Chem. Toxicol.* 75 (2015) 156–165.
- [8] J. Jarallah, T. Khoja, M. Izmirly, Reports of bacterial food poisoning in the Riyadh Region of Saudi Arabia: a one-year retrospective study, *Saudi Med. J.* 14 (1993), 46–46.
- [9] C. Gaulin, Y.B. Viger, L. Fillion, An outbreak of *Bacillus cereus* implicating a part-time banquet caterer, *Can. J. Public Health* 93 (2002) 353–355.
- [10] B. Bhandari, P. Saxena, D. Khadka, Study of Socio-Demographic Profile of Pesticidal Poisoning Cases in Tertiary Care Center, *J. Nepalgunj Med. Coll.* 16 (2018) 54–57.
- [11] D. Tagwireyi, D. Ball, C. Nhachi, Poisoning in Zimbabwe: a survey of eight major referral hospitals, *J. Appl. Toxicol. Int. J.* 22 (2002) 99–105.
- [12] A.I. Fathelrahman, A.F. Ab Rahman, Z. Mohd Zain, MS 04-044: demographic features of drug and chemical poisoning in northern Malaysia, *Clin. Toxicol.* 43 (2005) 89–94.
- [13] A. Sobhani, H. Shojaii-Tehrani, E. Nikpour, R.N. Norouzi, Drug and chemical poisoning in Northern Iran, *Arch Iranian Med* 2000 (2) (2000) 3.
- [14] A. Mahabshetty, K. Aithal, B. Patil, Profile of acute poisoning cases at a tertiary care hospital, *Medica Innovatica* 2 (2013) 81–86.
- [15] Z. Nazzal, H. Said, M. Al-Hajiri, O. Tamim, Salmonella food poisoning associated with macaroni salad in a labourers camp-state of Qatar, 2010, *J. Community Med. Health Educ.* 2 (2012), 2161-0711.1000145.
- [16] G. Schroeder, S. Bates, J. Spallino, Amnesic shellfish poisoning: emergency medical management, *J. Marine Sci. Res. Dev.* 6 (2015) 2.
- [17] J. Best, H. Bilgi, D. Heider, et al., The GALAD scoring algorithm based on AFP, AFP-L3, and DCP significantly improves detection of BCLC early stage hepatocellular carcinoma, *Z. Fä/r Gastroenterol.* 54 (2016) 1296–1305.
- [18] I. Ali, K.K. Sawlani, D. Himanshu, et al., Study of pattern and outcome of acute poisoning cases at tertiary care hospital in north India, *J. Evid. Based Med. Healthc* 4 (2017) 2349–2570.
- [19] S.V. Kumar, B. Venkateswarlu, M. Sasikala, G.V. Kumar, A study on poisoning cases in a tertiary care hospital, *J. Nat. Sci. Biol. Med.* 1 (2010) 35.
- [20] T.S. Chala, H. Gebramariam, M. Hussien, Two-year epidemiologic pattern of acute pharmaceutical and chemical poisoning cases admitted to Adama Hospital Medical College, Adama, Ethiopia, *Asia Pacific J. Med. Toxicol.* 4 (3) (2015) 106–111.
- [21] M. Bakhaidar, S. Jan, F. Farahat, A. Attar, B. Alsaywid, W. Abuznadah, Pattern of drug overdose and chemical poisoning among patients attending an emergency department, western Saudi Arabia, *J. Community Health* 40 (2015) 57–61.
- [22] C. Negrei, B. Galateanu, M. Stan, et al., Worldwide legislative challenges related to psychoactive drugs, *DARU J. Pharm. Sci.* 25 (2017) 14.
- [23] E. Ozcagli, B. Alpertunga, C. Fenga, et al., Effects of 3-monochloropropane-1, 2-diol (3-MCPD) and its metabolites on DNA damage and repair under in vitro conditions, *Food Chem. Toxicol.* 89 (2016) 1–7.
- [24] A.I. Vardavas, E. Ozcagli, P. Fragkiadaki, et al., The metabolism of imidacloprid by aldehyde oxidase contributes to its clastogenic effect in New Zealand rabbits, *Mutat. Res. Toxicol. Environ. Mutagen.* 829 (2018) 26–32.
- [25] M. Moazzam, A. Al Saigul, M. Naguib, M. Al Alfi, Pattern of acute poisoning in Al-Qassim region: a surveillance report from Saudi Arabia, 1999–2003, *EMHJ-Eastern Mediterranean Health J.* 15 (4) (2009) 1005–1010, 2009.
- [26] A. Saddique, Poisoning in Saudi Arabia: ten-year experience in king khaled university hospital, *Ann. Saudi Med.* 21 (2001) 88–91.
- [27] A. Ahmadi, N. Pakravan, Z. Ghazizadeh, Pattern of acute food, drug, and chemical poisoning in Sari City, Northern Iran, *Hum. Exp. Toxicol.* 29 (2010) 731–738.
- [28] K. Angelo, A. Nisler, A.J. Hall, L. Brown, L. Gould, Epidemiology of restaurant-associated foodborne disease outbreaks, United States, 1998–2013, *Epidemiol. Infect.* 145 (2017) 523–534.
- [29] K. Raghu, P. Shreevani, S.S. Kumar, S. Gopal, M.V. Shaik, B. Ahammed, Incidence and outcome of poisoning patients in a tertiary care teaching hospital, *Asian Journal of Pharmacology and Toxicology* 3 (2015) 23–26.
- [30] S. Alnasser, S.M. Hussain, T.S. Kirdi, A. Ahmed, Aluminum phosphide poisoning in Saudi Arabia over a nine-year period, *Ann. Saudi Med.* 38 (2018) 277–283.
- [31] Z.A.E. Abd-Elhaleem, B. Al Muqhem, Pattern of acute poisoning in Al Majmaah region, Saudi Arabia, *Am. J. Clin. Exp. Med.* 2 (2014) 79–85.
- [32] A. Giwa, E. Oey, The return of an old nemesis: survival after severe tricyclic antidepressant toxicity, a case report, *Toxicol. Rep.* 5 (2018) 357–362.
- [33] N. Mittal, N. Shafiq, A. Bhalla, P. Pandhi, S. Malhotra, A prospective observational study on different poisoning cases and their outcomes in a tertiary care hospital, *SAGE Open Med.* 1 (2013), 2050312113504213.
- [34] P.K. Nair, N.G. Revi, One-year study on pattern of acute pharmaceutical and chemical poisoning cases admitted to a tertiary care hospital in Thrissur, India, *Asia Pac. J. Med. Toxicol.* 4 (2015) 79–82.
- [35] B. Edelu, O. Odetunde, C. Eke, N. Uwaezuoke, T. Ogunu, Accidental Childhood Poisoning in Enugu, South-East, Nigeria, *Ann. Med. Health Sci. Res.* 6 (2016) 168–171.
- [36] H. Williams, E. Moyns, D.N. Bateman, S.H. Thomas, J.P. Thompson, J.A. Vale, Hazard of household cleaning products: a study undertaken by the UK National Poisons Information Service, *Clin. Toxicol.* 50 (2012) 770–775.
- [37] A. Ahmed, A.N. AlJamal, M.I.M. Ibrahim, et al., Poisoning emergency visits among children: a 3-year retrospective study in Qatar, *BMC Pediatr.* 15 (2015) 104.
- [38] S.H. Alzahrani, N.K. Ibrahim, M.A. Elnour, A.H. Alqahtani, Five-year epidemiological trends for chemical poisoning in Jeddah, Saudi Arabia, *Ann. Saudi Med.* 37 (2017) 282–289.
- [39] D.N. Juurlink, Activated charcoal for acute overdose: a reappraisal, *Br. J. Clin. Pharmacol.* 81 (2016) 482–487.
- [40] V.V. Wojciechowski, D. Calina, K. Tsarouhas, et al., A guide to acquired vitamin K coagulopathy diagnosis and treatment: the Russian perspective, *Daru J. Pharm. Sci.* 25 (2017) 10.
- [41] B. Chefirat, A. Zergui, C. Rahmani, et al., Acute paracetamol poisonings received at the oran university hospital, *Toxicol. Rep.* 7 (2020) 1172–1177.
- [42] S. Bhattacharyya, L. Pence, K. Yan, et al., Targeted metabolomic profiling indicates structure-based perturbations in serum phospholipids in children with acetaminophen overdose, *Toxicol. Rep.* 3 (2016) 747–755.
- [43] Y.K. Günaydın, N.B. Akullı, Z.D. Dündar, et al., Antiepileptic drug poisoning: three-year experience, *Toxicol. Rep.* 2 (2015) 56–62.