

Safety of dispensing prescribed iron formulation in child-resistant containers among pharmacies in Saudi Arabia: a cross-sectional survey

Nahar D. Alruwaili,¹ Mohammed Alomar,¹ Ismaeel Sabei,¹ Abdelmoneim Eldali²

¹Department of Emergency Medicine, King Faisal Specialist Hospital and Research Centre, Riyadh;

²Department of Biostatistics and Epidemiology, Research Centre, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia

Abstract

Iron overdose remains a significant public health threat to young children. Unit dose packaging of potent iron supplements is expected to reduce the frequency of severe pediatric iron overdose incidents. International regulations require child-resistant iron packages. We aim to know if iron is dispensed in child-resistant containers (CRCs) and to emphasize the importance of using them. A prospective cross-sectional observational study assessing the proper dispensing of ferrous sulfate tablets in CRCs from major city pharmacies. Forty government and private pharmacies were visited. Ferrous sulfates with a total of 600 to 6500 mg elemental iron per package were found. The package of 6000 mg was the most commonly found. Most of the packages with high concentrations are dispensed from the government hospitals and primary health-care centers pharmacies. None of the pharmacies dispensed iron in CRCs. To conclude, pharmacies dispensed iron in non-CRCs. Public health efforts on increasing awareness and improving packaging are highly needed. Authority regulations to use child-resistant iron packaging are required.

Introduction

Iron poisoning is a common pediatric toxicological emergency and this is related to the common uses of iron supplementation in substances for both children and adults.

Iron toxicity is usually described in four stages, although the clinical manifestations may overlap. Shortly after ingestion, the corrosive effects of iron cause vomiting and diarrhea, usually bloody. Massive fluid or blood loss may cause shock and death. Patients who sur-

vive this phase may experience a latent period of apparent improvement over 12 h. This may be followed by an abrupt relapse with coma, shock, seizures, metabolic acidosis, coagulopathy, hepatic failure, and death.

The severity of iron poisoning is based on the amount of elemental iron ingested which can be calculated based on elemental iron in the salt. Children may show signs of toxicity with ingestions of 10-20 mg/kg of elemental iron. Serious toxicity is likely with ingestions of more than 60 mg/kg.¹

Approximately 70% of the poisonings involved children younger than two years of age and approximately 59% of the poisonings involved oral prescription, and non-prescription drugs, or supplements.² Most substances involved in accidental ingestion had been stored where it was convenient to take, which made it readily accessible to children.

Children younger than six years make up the largest percentage of iron exposures.³

In 1970, the Poison Prevention Packaging Act (PPPA) authorizes the United States (US) Consumer Product Safety Commission (CPSC) to require the use of special child-resistant containers (CRCs) for a wide range of toxic substances used in or around the home including most oral prescription drugs.⁴ The PPPA defines special packaging as packaging that is designed or constructed to be significantly difficult for children under 5 years of age to open or obtain a toxic or harmful amount of the substance contained therein within a reasonable time and not difficult for normal adults to use properly, but does not mean packaging which all such children cannot open or obtain a toxic or harmful amount within a reasonable time.⁵ Unit-dose packaging of potent iron supplements is expected to reduce the frequency of severe pediatric iron overdoses incidents.⁶

Consumer Product Safety Commission regulations require child-resistant packaging for retail packages containing 250 mg or more of elemental iron.⁷

The use of CRCs yield no reported pediatric deaths in USA from iron poisoning in 2010 in the USA.⁸

Though exposures to iron and iron-containing products in the developed countries have been slowly dropping during the previous decade and due to significant public health efforts at increasing awareness and improving packaging, iron overdose remains a significant public health threat to young children.

There are more than seventy governmental and private hospitals, 377 governmental and 758 private dispensaries and 1924 private pharmacies in Riyadh region.⁹ However, there is a lack of research that examines the use of CRCs when dispensing oral iron tablets in local pharmacies in Riyadh. Currently, there are no laws regulating the use of CRCs in Saudi Arabia.

Correspondence: Nahar D. Alruwaili, Department of Emergency Medicine, King Faisal Specialist Hospital and Research Center, P.O. Box 3354 MBC 84, Takhassusi Street, 11211 Riyadh, Saudi Arabia.

Tel. +966.1.442.4425 - Fax: +966.1.442.3429.

E-mail: nalrowaili@kfshrc.edu.sa

Key words: child-resistant containers, iron poisoning, pediatric poisoning, child-resistant closures.

Contributions: NA, MA, and IS, proposal writing and data collection; AE, data analysis; NA and MA, manuscript writing.

Conflict of interests: the authors declare no potential conflict of interests.

Received for publication: 17 December 2012.

Revision received: 24 January 2013.

Accepted for publication: 2 February 2013.

This work is licensed under a Creative Commons Attribution 3.0 License (by-nc 3.0).

©Copyright N.D. Alruwaili et al., 2013

Licensee PAGEPress, Italy

Healthcare in Low-resource Settings 2013; 1:e6

doi:10.4081/hls.2013.e6

We hypothesized that CRCs are not used to dispense oral iron tablets. Hence, this study was to examine the use of CRCs when dispensing oral iron tablets at local pharmacies in Riyadh. The primary goal of this study was to survey the safety of dispensing prescribed iron formulations in CRCs among pharmacies in Riyadh city. The secondary goal of this study was to emphasize the importance of using CRC, as one of the best-documented successes in preventing the unintentional poisoning of children from pharmaceutical agents toxicity.

Materials and Methods

This was a prospective cross-sectional observational study of using CRCs in dispensing prescribed oral iron. The study was based on a structural unified questionnaire that was filled by the investigator during each visit to the pharmacies. A research participant information sheet was distributed to all participants. Informed consent was taken verbally by the investigator at the beginning of the study.

Forty pharmacies from governmental, private hospitals and dispensaries as well as commercially pharmacies were randomly selected from five different quarters in Riyadh.

Investigators were taught about different types and shapes of CRCs and each one of them was responsible to collect the data from the specific type and region of the pharmacies

to avoid any duplication. Ferrous sulfate tablets were selected as they are commonly prescribed in oral form for adults. The data were collected including: type of pharmacy, strength of the tablets, total amount of elemental iron per package and the use of CRCs. The confidentiality of collected data was protected. The Office of Research Affairs approval was obtained and verbal consent was obtained from participants. Each pharmacy was given a serial number without mentioning the name of the pharmacy during the data collection. Data collected were presented as mean standard deviation (SD) for continuous variables, and as percentages for categorical variables. The SAS version 9.2 was utilized to analyze the data.

Results

Forty government and private pharmacies were visited. Ferrous sulfates with a total of 600 to 6500 mg elemental iron per package were found (elemental iron range was 20-65 mg/tablet). The packages of 6000 mg (16 pharmacies) and 1800 mg (14 pharmacies) were the most commonly found (Table 1). Most of the packages with high concentrations are dispensed from the government hospitals and primary healthcare center pharmacies (Figure 1). All of the governmental hospitals dispensed iron with an amount equal or more than 4500 mg per package; all of government primary healthcare centres dispensed iron with an amount of 6000 mg per package; and all of the private pharmacies dispensed iron in amount equal or less than 300 mg per package. In this study we found that none of the pharmacies dispensed iron in CRCs.

Discussion

Unintentional child poisoning is an important public health concern and we need to implement strategies to prevent it by using CRC in dispensing iron tablets.

A review of mortality data in children younger than 5 shows a significant decrease in deaths after enforcement of the child-resistant packaging legislation.¹⁰⁻¹³ One of the CPSC studies done by Rodgers showed that there is a reduction in the rate of fatalities of up to 45% from levels in the absence of special packaging requirements for orally prescribed medications, resulted in about 24 fewer child deaths annually.⁵ Another study done by the same researcher found that the use of child-resistant packaging was associated with a 34%

reduction in the aspirin-related child mortality rate and this mortality rate reduction equates to the prevention of about 90 child deaths during the 1973-1990 post-regulatory period.¹¹

Walton found that unintentional poisoning of substances requiring child-resistant closures has declined from 5.7/1000 children in 1973 to 3.4/1000 children in 1978 and concluded that child-resistant closures have prevented nearly 200,000 accidental ingestions since 1973 till the time of his study. Over a 20-year period, the death rate due to poisonings of children has declined from 2.0/100,000 children to 0.5/100,000.¹⁴ Though this is the first pilot study in determining the use of CRCs in Saudi Arabia, we found that none of governmental or private pharmacies dispensed packages containing more than 250 mg of elemental iron in CRCs.

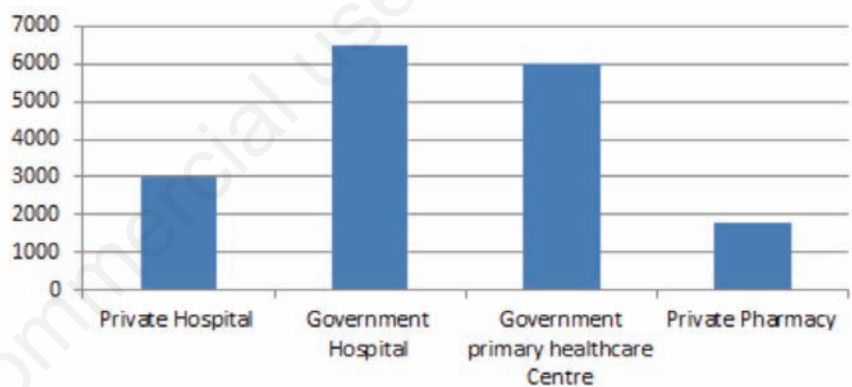


Figure 1. Maximum elemental iron per package (mg) dispensed from different healthcare structures.

Table 1. Iron per tablet and per package by pharmacy type.

Iron per tablet (mg)	Amount per package (mg)	Pharmacy type				Total
		Private hospital	Government hospital	Government primary healthcare centre	Private pharmacy	
20	600	1	0	0	0	1
30	900	1	0	0	0	1
45	1800	4	0	0	10	14
47	3000	4	0	0	0	4
60	4500	0	1	0	0	1
65	4700	0	1	0	0	1
100	6000	0	6	10	0	16
65	6500	0	2	0	0	2
Total		10	10	10	10	40
Use of CRC		No	No	No	No	

CRC, child-resistant container.

Most of the packages with high concentrations were dispensed from the governmental hospitals and primary healthcare centers pharmacies and this is related to the fact that we used the duration of 4-6 weeks instead of testing only one package in the other pharmacies to estimate the total of elemental iron per package. Even though it is recommended to use CRCs for prescribed oral medications there are several factors known to limit the effectiveness of CRC packaging regulations, including that CRCs are not childproof and the testing protocol requires only 80% of children less than 5 years of age to be unable to open child-resistant packages. Hence, even with the introduction of CRC in pediatrics, unintentional poisoning remains an important public health concern. Since iron poisoning is one of the fatal poisonings and needs to be dispensed in CRCs, we can generalize our study findings that other fatal medications are not dispensed in CRCs too in our region. The findings in this study are subject to several limitations. One of these is our sample size, but since we found all of the pharmacies not dispensing iron in CRCs, we think that increasing the sample size will not change the fact that there is no regulation to enforce its use.

Conclusions

Pharmacies dispense iron in non-CRCs. Public health efforts on increasing awareness and improving packaging are highly needed. Authority regulations to use child-resistant iron packaging are required.

References

1. Perrone J. Iron. In: Flomenbaum NE, Goldfrank LR, Hofman RS, Howland MA, Lewin NA, Nelson LS, eds. *Goldfrank's toxicologic emergencies*. 8th ed. New York, NY: McGraw-Hill; 2006. pp 629-42.
2. Franklin RL, Rodgers GB. Unintentional child poisoning treated in United States hospital emergency departments: national estimates of incident cases, population-based poisoning rates, and product involvement. *Pediatrics* 2008;122:1244-51.
3. Bronstein AC, Spyker DA, Cantilena LR, et al. Annual report of the American Association of Poison Control Centers' national Poison. Alexandria, VA: American Association of Poison Control Centers ed.; 2008.
4. American Regulation. Application of the Public Law 91-601, 84 Stat. 1670, Poison Prevention Packaging Act of 1970. 15 U.S.C, pp. 1471-1477. Available from: http://www.cpsc.gov/Global/PDF/Statues/pp_pa.pdf
5. Rodgers GB. The safety effect of child-resistant for oral prescription drugs. Two decades of experience. *JAMA-J Am Med Assoc* 1996;275:1661-5.
6. Morris C. Pediatric iron poisoning in the United States. *South Med J* 2000;93:352-8.
7. Office of the Federal Register. Certain preparations containing iron. Amendment to child-resistant packaging standards, 43 Federal Register 17332 (1978). Codified at 16 CFR, § 1700. Washington, DC: Office of the Federal Register ed.; 1976.
8. Bronstein AC, Spyker DA, Cantilena LR, et al. Annual report of the American Association of Poison Control Centers' national Poison. Alexandria, VA: American Association of Poison Control Centers ed.; 2010.
9. Ministry of Health, Saudi Arabia. Statistical book of the year 2009. Riyadh: Ministry of Health ed.; 2009. Available from: <http://www.moh.gov.sa/en/Ministry/statistics/Book/Pages/default.aspx> Accessed: 25/11/2011.
10. Schwartz MK. Poison prevention. *J Pediatr Health Car* 1993;7:143-4.
11. Rodgers GB. The effectiveness of child-resistant packaging for aspirin. *Arch Pediat Adol Med* 2004;156:929-33.
12. Liebelt EL, Shannon MW. Small doses, big problems: a selected review of highly toxic common medications. *Pediatr Emerg Care* 1993;9:292-7.
13. US Consumer Product Safety Commission. CPSC Requires Child-Resistant Packaging for Common Household Products Containing Hydrocarbons, Including Some Baby Oils. Bethesda, MD: US Consumer Product Safety Commission; 2002. Available from: <http://www.cpsc.gov/cpsc/pub/prerel/prhtml02/02015.html> Accessed: 25/11/2011.
14. Walton WW. An evaluation of the poison prevention packaging act. *Pediatrics* 1982;69: 363-70.