Unintentional Child Poisonings Through Ingestion of Conventional and Novel Tobacco Products

WHAT'S KNOWN ON THIS SUBJECT: Unintentional ingestion of tobacco products is a major reason for infant and child toxic exposures reported to poison control centers. The large majority (90%) of such accidental poisonings in the population involve children <6 years of age.

WHAT THIS STUDY ADDS: This study examines child poisonings resulting from ingestion of tobacco products, particularly ingestion of smokeless tobacco products, through analysis of poison control center data. The potential toxicity of novel smokeless tobacco products to young children is assessed.

AUTHORS: Gregory N. Connolly, DMD, MPH,[a] Patricia Richter, PhD,[b] Alfred Aleguas Jr, PharmD,[c] Terry F. Pechacek, PhD,[b] Stephen B. Stanfill, MS,[d] and Hillel R. Alpert, ScM[a]

[a]Division of Public Health Practice, School of Public Health, Harvard University, Boston, Massachusetts; [b]Office on Smoking and Health and [d]Emergency Response and Air Toxicants Branch, Centers for Disease Control and Prevention, Atlanta, Georgia; and [c]Northern Ohio Poison Control Center, Cleveland, Ohio

KEY WORDS

tobacco control policy, poisoning exposures, toxicity

www.pediatrics.org/cgi/doi/10.1542/peds.2009-2835

doi:10.1542/peds.2009-2835

Accepted for publication Jan 7, 2010

Address correspondence to Hillel R. Alpert, ScM, Harvard School of Public Health, Division of Public Health Practice, Landmark Building, Floor 3E, 401 Park Dr, Boston, MA 02215. E-mail: halpert@hsph.harvard.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2010 by the American Academy of Pediatrics

FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*

abstract

FREE

OBJECTIVE: This study examines child poisonings resulting from ingestion of tobacco products throughout the nation and assesses the potential toxicity of novel smokeless tobacco products, which are of concern with their discreet form, candy-like appearance, and added flavorings that may be attractive to young children.

METHODS: Data representing all single-substance, accidental poisonings resulting from ingestion of tobacco products by children <6 years of age, reported to poison control centers, were examined. Age association with ingestion of smokeless tobacco versus other tobacco products was tested through logistic regression. Total nicotine content, pH, and un-ionized nicotine level were determined, and the latter was compared with values for moist snuff and cigarettes.

RESULTS: A total of 13 705 tobacco product ingestion cases were reported, >70% of which involved infants <1 year of age. Smokeless tobacco products were the second most common tobacco products ingested by children, after cigarettes, and represented an increasing proportion of tobacco ingestions with each year of age from 0 to 5 years (odds ratio: 1.94 [95% confidence interval: 1.86–2.03]). A novel, dissolvable, smokeless tobacco product with discreet form, candy-like appearance, and added flavorings was found to contain an average of 0.83 mg of nicotine per pellet, with an average pH of 7.9, which resulted in an average of 42% of the nicotine in the un-ionized form.

CONCLUSION: In light of the novelty and potential harm of dissolvable nicotine products, public health authorities are advised to study these products to determine the appropriate regulatory approach. *Pediatrics* 2010;125:896–899

Downloaded from by guest on March 26, 2017

Recent estimates of product-related poisonings involving children, based on a national probability sample of US hospital emergency departments, underscore the insufficiency of existing child-resistant packaging and the need for additional child-poisoning prevention strategies.[1] Unintentional ingestion of tobacco products is a major reason for infant and child toxic exposures reported to poison control centers throughout the nation.[2] The large majority (90%) of such accidental poisonings in the population involve children <6 years of age.[2] In addition to conventional smokeless tobacco products, novel smokeless tobacco products, including dissolvable, compressed, tobacco products called Camel Orbs (R. J. Reynolds Tobacco Company, Winston-Salem, NC), are now of major concern, with their discreet form, candy-like appearance, and added flavorings that may be attractive to young children.

Infants are susceptible to accidental tobacco ingestion because of a natural curiosity and a tendency for oral exploration.[3,4] As taste discrimination develops, young children may be more attracted to flavored tobacco products.[5] Ingestion of as little as 1 mg of nicotine by a small child can produce symptoms such as nausea and vomiting.[6] Severe toxic effects of nicotine ingestion may include weakness, convulsions, unresponsiveness, and impaired respiration and ultimately may lead to respiratory arrest and death.[6] The estimated minimal lethal pediatric dose is 1.0 mg of nicotine per kilogram of body weight.[7]

The present study examines child poisonings resulting from ingestion of tobacco products throughout the nation and trends in ingestion of smokeless tobacco products in particular. The potential toxicity of novel smokeless tobacco products to young children is assessed.

METHODS

Case data from the National Poison Data System, compiled by the American Association of Poison Control Centers from reports of 61 regional poison control centers serving the nation, were examined. Age- and gender-specific case frequencies were computed for all single-substance, accidental poisonings resulting from ingestion of tobacco products by children <6 years of age during the period 2006–2008. Logistic regression analysis was performed by controlling for year of ingestion as a categorical variable and gender, to assess any age association with ingestion of smokeless tobacco versus other tobacco products (cigarettes, filter tips, cigars, other or unknown).

Multiple packs of 2 varieties of Camel Orbs (designated "Fresh" and "Mellow"), a novel, smokeless tobacco product sold in 3 test markets, were measured for nicotine content through gas chromatography-mass spectrometry[8] and pH analyses, as described elsewhere.[9] The proportion of nicotine in the un-ionized form was calculated by substituting measured pH and the appropriate pK_a of nicotine (8.02) into the Henderson-Hasselbalch equation.[10]

RESULTS

Age- and gender-specific case frequencies for each tobacco product type, including smokeless tobacco (chewing tobacco and snuff), cigarettes and used filter tips, cigars, and others, are shown in Table 1. A total of 13 705 cases were reported for all types of tobacco products (Table 1). The majority (>70%) of ingestions were by infants <1 year of age (Table 1). Smokeless tobacco products represented an increasing proportion of tobacco ingestions with each year of age from 0 to 5 years (odds ratio: 1.94 [95% confidence interval: 1.86–2.03]). Year of ingestion was not statistically significant ($P \leq .127$) in the model. Smokeless products were the second most common tobacco product ingested by children, after cigarettes. Orbs pellets sold in 3 test markets were found to contain an average of 0.83 mg of nicotine per pellet, with an average pH of 7.9, which resulted in an average of 42% of the nicotine in the un-ionized form.

TABLE 1 Child Ingestions With Tobacco Products as the Primary Substance of Exposure, as Reported to US Poison Control Centers in 2006–2008

Type of Tobacco Product	*n*						
	0 y	1 y	2 y	3 y	4 y	5 y	Total
Boys							
Smokeless tobacco	316	84	202	54	20	10	686
Cigarettes and filter tips	3763	523	420	64	18	8	4796
Cigars	48	2	17	1	1	0	69
Other/unknown type	270	66	94	27	11	10	478
Girls							
Smokeless tobacco	390	109	383	135	38	25	1080
Cigarettes and filter tips	4350	625	608	102	44	12	5741
Cigars	61	9	24	3	1	0	98
Other/unknown type	326	116	161	67	31	16	717
All (including gender unknown)							
Smokeless tobacco	706	195	585	189	58	35	1768
Cigarettes and filter tips	8138	1153	1032	168	62	20	10 573
Cigars	109	11	41	4	2	0	167
Other/unknown type	597	182	256	94	42	26	1197
Total	9550	1541	1914	455	164	81	13 705

Data were from the National Poison Data System of the American Association of Poison Control Centers.

Downloaded from by guest on March 26, 2017

DISCUSSION

The present findings raise concern in light of the recent increase in the prevalence of smokeless tobacco use among adolescents (average increase of 6% per year from 2002 to 2006) and the proliferation of new forms of smokeless tobacco products, including new flavored brands.[11] In 2009, the R. J. Reynolds Tobacco Company introduced a novel, dissolvable, compressed tobacco product called Camel Orbs, which according to the promotional literature contains 1 mg of nicotine per pellet, as well as Camel Sticks with 3.1 mg of nicotine per stick and Camel Strips with 0.6 mg of nicotine per strip. Orbs are flavored with cinnamon or mint and resemble popular candies such as Tic Tacs (Ferrero, Somerset, NJ) or M&Ms (Mars Incorporated, McLean, VA) more than conventional tobacco products (Fig 1). Such products are designed and marketed not for smoking cessation but rather as temporary substitutes for cigarettes when smoking is not allowed.

We found the average pH of an Orbs pellet to be 7.9, which is more alkaline than cigarette tobacco (pH $<$ 6.0) and results in an average of 42% of the nicotine in the un-ionized form, compared with averages of 28–30% for moist snuff and $<$10% for cigarettes.[12,13] Un-ionized nicotine is absorbed more rapidly in the mouth, which might enhance toxicity.[6] Furthermore, the discreet form of Orbs might make ingestion of nicotine, a highly addictive drug, easy and attractive for adolescents.

At least 1 case of ingestion of Orbs by a 3-year-old child (Oregon Poison Control Center, personal written and oral communication, July 27, 2009) and 2 cases of mild poisonings in children 2 and 3 years of age resulting from ingestion of snus (a flavored, oral, tobacco product packed in small paper pouches and sold without explicit warning to protect against child ingestion) (Indiana Poison Control Center, personal written communication, May 13, 2009) have been reported. The R. J. Reynolds Tobacco Company claims that Orbs packaging is child-resistant, but adults might take multiple pellets out of the container for convenience and unknowingly leave them where infants or children might find and ingest them.

FIGURE 1
Comparison of Orbs tobacco pellets and Tic Tac candies.

The newly signed Family Smoking Prevention and Tobacco Control Act, which provides the Food and Drug Administration with certain authority to regulate tobacco products, prohibits cigarette constituents or additives that provide a characterizing flavor to the tobacco or tobacco smoke. This prohibition does not apply to other tobacco products. Because reports of toxic exposure to tobacco products are monitored, public health officials and poison control centers should be alert to reports of ingestion of novel products that claim to be tobacco products but more closely resemble candies or foods. In light of the novelty and potential harm of these dissolvable nicotine products, federal and other public health authorities are advised to study these products to determine the appropriate regulatory approach, on the basis of their potential to cause poisonings and to create addiction among youths.

ACKNOWLEDGMENT

We are grateful to Angela Kuo for performing the gas chromatography-mass spectrometry and pH analysis of the Camel Orbs samples. Use of trade names is for informational purposes only and in no way implies endorsement by the U.S. Government, the U.S. Department of Health and Human Services, or CDC. The findings and conclusions in this report are those of the authors and do not necessarily represent the views of CDC.

REFERENCES

1. Franklin RL, Rodgers GB. Unintentional child poisonings treated in United States hospital emergency departments: national estimates of incident cases, population-based poisoning rates, and product involvement. *Pediatrics*. 2008;122(6):1244–1251

Downloaded from by guest on March 26, 2017

2. Bronstein AC, Spyker DA, Cantilena LR Jr, et al. 2007 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 25th Annual Report. *Clin Toxicol (Phila)*. 2008; 46(10):927–1057
3. Goepferd SJ. Smokeless tobacco: a potential hazard to infants and children. *J Am Dent Assoc*. 1986;113(1):49–50
4. Johnson CP, Blasco PA. Infant growth and development. *Pediatr Rev*. 1997;18(7): 224–242
5. Cowart BJ. Development of taste perception in humans: sensitivity and preference throughout the life span. *Psychol Bull*. 1981;90(1):43–73
6. Salomon ME. Nicotine and tobacco preparations. In: Goldfrank LR, Nelson LS, Howland MA, Lewin NA, Flumenbaum NE, Hoffman RS, eds. *Goldfrank's Toxicologic Emergencies*. 8th ed. New York, NY: McGraw-Hill; 2006: 1221–1230
7. McGuigan MA. Nicotine. In: Dart RC, ed. *Medical Toxicology*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2003:601–604
8. Stanfill SB, Jia LT, Ashley DJ, Watson CH. Rapid and chemically selective nicotine quantification in smokeless tobacco products using GC-MS. *J Chromatogr Sci*. 2009; 47(10):902–909
9. Centers for Disease Control and Prevention. Notice regarding revisions to the laboratory protocol to measure the quantity of nicotine contained in smokeless tobacco products manufactured, imported, or packaged in the United States. *Fed Regist*. 2008; 73(51):13903–13909
10. Henderson LJ. Concerning the relationship between the strength of acids and their capacity to preserve neutrality. *Am J Physiol*. 1908;21:173–179
11. Alpert HR, Koh H, Connolly GN. Free nicotine content and strategic marketing of moist snuff tobacco products in the United States: 2000–2006. *Tob Control*. 2008;17(5): 332–338
12. Massachusetts Department of Public Health. *105 CMR 660.000: Cigarette and Smokeless Tobacco Products: Reports of Added Constituents and Nicotine Ratings*. Boston, MA: Massachusetts Department of Public Health; 2008
13. Richter P, Hodge K, Stanfill S, Zhang L, Watson C. Surveillance of moist snuff: total nicotine, moisture, pH, un-ionized nicotine, and tobacco-specific nitrosamines. *Nicotine and Tobacco Research*. 2008;10: 1645–1652

As Increased Rate of Autism Identified in Los Angeles : *A child born in Los Angeles is four times as likely to be diagnosed with autism as a child born anywhere else in California according to an article in* The Wall Street Journal *(Beck M, February 1, 2010). While pockets of increased rates of autism are appearing around the country, a few recent studies, including one in the* Journal of Health and Place*, looked at the Los Angeles area as one such pocket to try to explain why. The good news is that vaccines are not the reason. On the other hand, local environmental and social factors that are still not well characterized appear to play key roles. In the Los Angeles area, for example, social influences, such as the sharing of information about this disorder, may lead more parents to ask about it and have pediatricians more prone to be on the lookout for it. The studies cited in this article attribute the increase to everything from family affluence to the work of autism advocacy groups to air and water pollution. Whether these differences in Los Angeles or elsewhere in the country represent variations in local awareness, record keeping, or actual higher risk remains to be determined.*

Noted by JFL, MD

Downloaded from by guest on March 26, 2017

Unintentional Child Poisonings Through Ingestion of Conventional and Novel Tobacco Products

Gregory N. Connolly, Patricia Richter, Alfred Aleguas, Jr, Terry F. Pechacek, Stephen B. Stanfill and Hillel R. Alpert

Pediatrics; originally published online April 19, 2010;
DOI: 10.1542/peds.2009-2835

Updated Information & Services	including high resolution figures, can be found at: /content/early/2010/04/19/peds.2009-2835
Citations	This article has been cited by 21 HighWire-hosted articles: /content/early/2010/04/19/peds.2009-2835#related-urls
Permissions & Licensing	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: /site/misc/Permissions.xhtml
Reprints	Information about ordering reprints can be found online: /site/misc/reprints.xhtml

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2010 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Downloaded from by guest on March 26, 2017

PEDIATRICS®
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Unintentional Child Poisonings Through Ingestion of Conventional and Novel Tobacco Products

Gregory N. Connolly, Patricia Richter, Alfred Aleguas, Jr, Terry F. Pechacek, Stephen B. Stanfill and Hillel R. Alpert

Pediatrics; originally published online April 19, 2010;
DOI: 10.1542/peds.2009-2835

The online version of this article, along with updated information and services, is located on the World Wide Web at:
/content/early/2010/04/19/peds.2009-2835

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2010 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Downloaded from by guest on March 26, 2017