



Contents lists available at ScienceDirect

Journal of the American Pharmacists Association

journal homepage: www.japha.org

RESEARCH

Knowledge of dosing directions among current users of acetaminophen-containing medications

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ARTICLE INFO

Article history:

Received 16 January 2018

Accepted 7 June 2018

ABSTRACT

Objectives: Users should know the active ingredients and dosing directions to optimize the safe use of acetaminophen-containing medications. The aim of this work was to examine knowledge of acetaminophen-containing medication directions among current users.

Design, setting, and participants: An Internet panel diary study (2012–2016) of 1-week usage of acetaminophen medications (over-the-counter [OTC] and prescription), recorded daily; 9629 participants. Users were asked about ingredients of medications taken; specific dosing instructions were asked for each OTC medication taken. Subjects were considered to be correct only if an accurate response was provided for all of the medications they used.

Outcome measures: Analyses examined prevalence of several aspects of knowledge and their relation to the corresponding deviations from directions. Knowledge that acetaminophen was an ingredient was compared between medication types.

Results: Two-thirds of 5161 participants who used only 1 acetaminophen medication knew the ingredient; the proportion was almost halved in 4468 users of 2 or more. Ingredient knowledge was highest for single-ingredient medications (74%); for combination medications it ranged from 39% (cough or cold) to 61% (sleep or other non-pain). About one-third knew the prohibition against concomitant use of multiple acetaminophen medications; 85% knew the maximum one-time OTC dose, but only 47% knew the minimum interval between doses. Correct knowledge was inversely associated with violating the relevant label directions; in particular, knowing the one-time dose decreased the odds of taking too much at one time fivefold. Knowing both the ingredient and the concomitant use prohibition decreased the odds of concomitant use by 50%.

Conclusions: Knowledge of directions for safe use of acetaminophen-containing medications is poor, and its deficiency is associated with corresponding deviations from label instructions. This study demonstrates a need for education about safe use of acetaminophen-containing medications, particularly for combination products.

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Acetaminophen is widely used in single-ingredient medications for pain and fever; it is also an ingredient in hundreds of over-the-counter (OTC) and prescription (Rx) combination medications.¹ Combination acetaminophen OTC medications can contain other analgesics, antihistamines, and

decongestants and may be used to treat cold, flu, and allergy and as sleep aids; acetaminophen is combined with narcotic analgesics in many Rx medications. Because they contain multiple ingredients, combination medications, both OTC and Rx, may obscure the presence of acetaminophen.²

Disclosures: D.W.K. received research support from Bayer Healthcare Pharmaceuticals during the conduct of the study and was a consultant to UCB. M.K.M. is a consultant to McNeil Consumer Healthcare (now Johnson & Johnson Consumer) on other projects. R.B.W. is an employee of Janssen Research and Development. Both McNeil Consumer Healthcare and Janssen Research and Development are part of Johnson & Johnson. S.S., D.R.B., and Pinney Associates are consultants to McNeil Consumer Healthcare (now Johnson & Johnson Consumer) and other companies that market over-the-counter analgesics,

including Bayer, Chattem, GlaxoSmithKline, and Pfizer. J.P.K. has no financial disclosures.

Funding: Sponsored by McNeil Consumer Healthcare (now Johnson & Johnson Consumer), which markets Tylenol-brand acetaminophen medications. Decisions about the content and submission were made solely by the authors.

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Key Points**Background:**

- Acetaminophen is widely used in single-ingredient medications for pain and fever; it is also an ingredient in hundreds of over-the-counter (OTC) and prescription combination medications. Though generally safe when taken as directed, overdose can lead to potentially life-threatening liver injury.
- The labeling of acetaminophen medications is intended to direct consumers' use. Knowledge of dosing recommendations is important for correct dosing behavior.
- We previously found that knowing that medications contain acetaminophen and knowing the maximum one-time dose reduced the likelihood of exceeding the maximum recommended daily dose.

Findings:

- There is a low level of knowledge among recent acetaminophen medication users about what medications contain acetaminophen and how to use them. Only 34% of respondents who had used 2 or more medications (nearly one-half of the subjects) could identify acetaminophen as an ingredient; only 15% exhibited both ingredient knowledge and knowledge of the prohibition against concomitant use of multiple acetaminophen products. Most OTC users knew how much to take at one time, but fewer than half knew the minimum redosing interval.
- Ingredient knowledge was particularly poor for combination products used to treat upper respiratory symptoms, which accounted for a substantial proportion of use.
- Specific types of acetaminophen knowledge were related to specific deviations from label instructions: knowing how much of an OTC medication to take at one time and knowing the minimum redosing interval were associated with large decreases in the odds of taking too much at one time and redosing too soon, respectively; a significant reduction in the odds of concomitant use was observed only for knowing both the medication ingredients and the prohibition against concomitant use, not when either type of knowledge was present without the other.
- This study demonstrates a need for improved education about safe use of acetaminophen-containing medications, particularly for OTC combination products. In addition to mass consumer initiatives, health care providers and pharmacists have an important role to play in educating individual users.

The labeling of acetaminophen medications is intended to direct consumers' use. Taken as directed, the risk of serious adverse effects is low, but overdose can lead to potentially life-threatening liver injury.^{1,3} Many reported overdoses are the result of deliberate self-harm, but a substantial proportion are unintentional; for example, 30% of acetaminophen-related emergency room visits, amounting to more than 23,000 annually, have been attributed to unintentional overdose.⁴ The problem of unintentional overdosing of acetaminophen has been of sufficient concern for the U.S. Food and Drug Administration (FDA) to convene an Advisory Committee on the subject in 2009.^{5,6} A number of additional initiatives have since been taken, including industry-sponsored Internet campaigns to inform consumers about safe usage,^{7,8} reducing the label-recommended maximum daily dose of 500 mg single-ingredient OTC products from 8 to 6 pills a day,^{9,10} lowering the maximum recommended daily dose of 325-mg single-ingredient products and some combination products from 12 to 10 pills,⁹ recommending "acetaminophen" to be spelled out on Rx labels,¹¹ and limiting the acetaminophen strength in Rx products to 325 mg per tablet.¹²

Until recently, safe use of Rx medications may have been hampered by label inconsistencies and abbreviations that were not easily recognized.^{13,14} Labels on OTC medications may not be read or understood, or they may be disregarded. The Drug Facts label on OTC acetaminophen medications² includes the active ingredient, maximum amount to take at one time, maximum daily amount, and minimum interval between doses. The label also cautions users to take only 1 acetaminophen-containing medication at a time, to limit the combined dosage. Avoiding concomitant use requires knowing both this direction and what medications contain acetaminophen. We have previously shown that 3 types of deviations from acetaminophen label directions—taking too many doses at one time, redosing with the same medication too soon, and concomitant use of 2 or more medications—are associated with exceeding the daily maximum dose (4 grams).¹⁵

Knowledge of correct dosing is an obvious prerequisite for correct dosing behavior. A number of studies have evaluated acetaminophen medication knowledge,^{2,16–25} though few have examined knowledge among recent acetaminophen users or its relation to actual dosing behavior, which seems particularly relevant. We previously found that knowing that medications contain acetaminophen and the maximum one-time dose was inversely associated with the probability of exceeding the maximum daily dose.²⁶

Here we examine the prevalence of specific aspects of knowledge regarding acetaminophen medications that consumers recently took and the relationships to the corresponding deviations from directions. We also assess whether ingredient knowledge varies with different types of medications.

Methods

The data were collected in a nationwide Internet diary study conducted to obtain information on knowledge, attitudes, and self-dosing practices among U.S. acetaminophen users. The methods have been described in detail elsewhere^{15,26} and will be reviewed here briefly.

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