Food Color Facts

What you should know about approved food additives.

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Often, the names given to additives and other ingredients in our food products can make them seem confusing and off-putting, even to the savviest shopper. But food additives perform specific, positive functions in food, such as enhancing safety and freshness and improving the taste, texture and appearance of products. In the United States, the Food and Drug Administration (FDA) oversees the safety of food additives and allows only the use of those that are deemed safe. Color additives (also known as food colors) are one category of approved food additives. They not only play a key role in the enjoyment of our food; they also do so without posing a health risk to consumers.

Why are food colors used?

According to expert Charles Spence, in his article "On the psychological impact of food color," "color is the single most important sensory cue to expectations about the likely taste and flavor of food and drink." Food colors often allow us to easily identify our preferred food choices and can enhance a food's overall appeal. They may augment the naturally occurring color of a food and/or provide a consistent color in a food for which the color may vary (due to, for example, exposure to light, air, temperature extremes, moisture, storage conditions, or production elements).

Food Color Categories

Certified colors are synthetically produced (or human-made) and used widely because they impart an intense, uniform color and blend more easily to create a variety of consistent hues. There are nine certified color additives approved for use in the United States:

Citrus Red No. 2
- Approved only for adding color to orange peels

FD&C Red No. 3
- Found in confections, beverages, cereals, ice cream cones, frozen dairy desserts, popsicles, frostings and icings

FD&C Red No. 40
- Found in cereals, beverages, gelatins, puddings, dairy products and confections

FD&C Yellow No. 5
- Found in confections, cereals, snack foods, beverages, condiments, baked goods and yogurt

FD&C Yellow No. 6
- Found in cereals, snack foods, baked goods, gelatins, beverages, dessert powders, crackers and sauces

FD&C Blue No. 1
- Found in confections, beverages, cereals, frozen dairy desserts, popsicles, frostings and icings

FD&C Blue No. 2
- Found in baked goods, cereals, snack foods, ice cream, confections and yogurt

FD&C Green No. 3
- Found in cereals, ice cream, sherbet, drink mixers and baked goods

Orange B
- Approved only for use in hot dog and sausage casings

Colors that are **exempt from certification** include both pigments derived from natural sources such as vegetables, minerals or animals as well as hues derived from synthetic origins. Examples include beta carotene and calcium carbonate. Color additives that are exempt from certification may have more variable hues than certified colors due to their sensitivities to light and pH; they may also add unintended flavors to foods. Examples of exempt colors include annatto extract (which imparts a yellow hue), dehydrated beets (which creates hues ranging from bluish-red to brown), caramel (which creates yellow-to-tan hues), beta carotene (which yields yellow-to-orange hues) and grape skin extract (which produces red and green hues).

Certified color additives are categorized as either dyes or lakes. Dyes dissolve in water and are manufactured as powders, granules, liquids or other special-purpose forms. They can be used in beverages, dry mixes, baked goods, confections, dairy products, pet foods and a variety of other products.

Lakes are the water-insoluble forms of dyes. Lakes are more stable than dyes and are ideal for coloring products containing fats and oils or items lacking enough moisture to dissolve dyes. Typical uses include coated tablets, cake and donut mixes, hard candies and chewing gums.

Are Food Colors Safe?

Food colors have been evaluated for safety by several regulatory authorities worldwide. In the U.S., the FDA is responsible for determining the safety of all food colors for their specified intended use. Before a new color can be used or before an existing color can be used for a different purpose, a color additive petition must be submitted to the FDA for approval. The petition contains scientific data demonstrating that the color is safe for use in the intended way. The FDA evaluates the data and comes to its own conclusion based on the chemical composition of the substance, how much of the color can be consumed in foods (the concentration to be used), immediate and long-term health effects, and other safety factors. If the color additive is approved, the FDA will establish limits on products in which the color can be used, in what quantities it can be applied (also known as its usage rate), as well as how the additive should appear on food labels. If in the future there is new scientific evidence about a color additive, the FDA will reassess all information and decide whether changes are warranted.

As mentioned above, colors also must go through a certification process prior to their use in food. A sample from every batch of color additive must be submitted to the FDA for testing to ensure it meets specifications for approval.

Non-certified colors, also known as exempt colors, do not go through this certification process but are still subject to comply with U.S. Pharmacopeia or Food Chemicals Codex specifications.

Food Colors Across the Globe

CODEX Alimentarius, the international food standards body of the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization, standardizes the safe use of food additives across various global regions and is considered the worldwide standard for food additive safety. These standards ensure the safe global trade of color additives.

Numerous developed countries adopt their own standards based on CODEX specifications. A few examples are listed below.

- In Europe, the European Food Safety Authority (EFSA) is the leading food safety regulatory agency. In the EU, color additives must be declared by the category name (color) and E number of the specific color, e.g., Color (E 171). Between 2009 and 2016, the EFSA panel on Additives and Nutrient Sources (ANS) reevaluated the safety of all previously authorized food colors as part of its review of all food additives in use before January 2009. Overall, the ANS panel reassessed 41 food colors and considered new data where available.
- In the United Kingdom, the Food Standards Agency (FSA) assesses the safety of food additives before they can be used in food. The FSA ensures that new science on additives is strictly reviewed and that the law is enforced in order to ensure public health. FSA investigates any information that would call into doubt the safety of a food additive.
- In Japan, the Specifications and Standards for Foods, Food Additives, etc., is published by the Japan External Trade Organization (JETRO) and lists colors and additives that are permitted. Colors can be considered under various categories that define their use in food.

Food Colors and Behavior

Scientific studies on the potential relationship between food colors and hyperactivity in the human body have been conducted for over 50 years. To date, most scientific experts agree that there is insufficient clinical evidence to support a causal relationship between food color consumption and increased hyperactivity; the present scientific consensus is that more research is needed on this topic.

Early research in the 1970s suggested a causal relationship between food and color additives and both hyperactivity and learning issues in children. This research led by Dr. Ben Feingold, who received notoriety for creating an avoidance diet (free of artificial food colors, flavors, and natural salicylates) that he published in a best-selling book. Prior to Feingold's work, there had been no other studies looking at food colors and hyperactivity. Following Feingold's work, researchers sought to study his theory using various methodologies. In 1983, an analysis of 23 studies demonstrated that diet modification was not an effective treatment for hyperactivity. Additionally, research by D. McCann et al. also found minimal correlations between the consumption of food colors and an increase in hyperactivity.

Continued controversial research regarding food colors and behavior has prompted the FDA to take a closer look. In 2011, the FDA examined whether there was a causal link between food colors and hyperactivity in children. The FDA's Food Advisory Committee reviewed numerous studies and listened to two days of expert and public testimony. At the end of the process, the FDA concluded that a "causal relationship between food colors and hyperactivity in children has not been established."

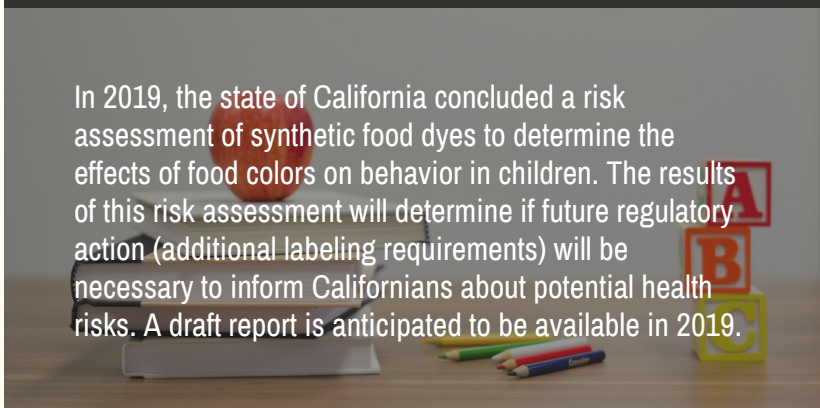
ADHD: An Evolving Behavioral Health Concern

Attention deficit hyperactivity disorder (ADHD) is a complex, multifactorial, and highly genetic disorder, the symptoms of which include hyperactivity, low frustration tolerance, impulsivity, and inattention. ADHD affects children as well as adults. According to the Centers for Disease Control and Prevention (CDC), "there has been an upward trend in national estimates of parent-reported ADHD diagnoses across different surveys, using different age ranges. It is not possible to tell whether this increase represents a change in the number of children who have ADHD, or a change in the number of children who were diagnosed." These variances lead some to question the accuracy of diagnoses, especially in children.

A review of the literature by W. Johnson et al., suggests, "An added difficulty in diagnosing ADHD is that if often coexists with other problems. Many children with ADHD also have a specific learning disability, which means that they have trouble mastering language of certain skills, such as reading, math or handwriting. Although ADHD is not categorized as a learning disability, its interference with concentration and attention can make it even more difficult for a child to perform well in school."

The European Food Safety Authority (EFSA) completed an assessment of several studies conducted at the University of Southampton in the United Kingdom in 2008 that found:

- *The Southampton study provided only limited evidence that additives had a small effect on activity and attention on children; and*
- *The significance of the effects was unclear. The EFSA confirmed that these results cannot be used as a basis for altering the acceptable daily intakes (ADIs) of color additives.*
- *EFSA concluded in 2009 that the available scientific evidence does not substantiate a link between color additives and behavioral effects.*



In 2019, the state of California concluded a risk assessment of synthetic food dyes to determine the effects of food colors on behavior in children. The results of this risk assessment will determine if future regulatory action (additional labeling requirements) will be necessary to inform Californians about potential health risks. A draft report is anticipated to be available in 2019.

Adverse Reactions to Food Additives

Many individuals believe food additives are the cause of adverse allergic reactions. In fact, most studies show that only a few cause adverse reactions in a small number of people. Whether you have a confirmed food allergy to one of the eight most common allergens, or you think you're sensitive to food additives, it's important to read the ingredient statement on a product to confirm whether or not a specific additive is in it. By reading the list of ingredients, consumers have the power to make informed purchase decisions.

Allergic reactions are a form of an adverse reaction to foods. These are IgE-mediated reactions and affect an individual's immune system. Allergic reactions require immediate medical attention and, in most cases, epinephrine. There are currently eight foods that account for 90% of allergic reactions in the U.S.

Sensitivities and intolerance are two other types of adverse reactions that can occur from food. These reactions are non-IgE mediated and are not life-threatening (as allergic reactions can be). They typically affect an individual's digestive system and do not require the use of epinephrine as a treatment. Common examples include lactose intolerance and sensitivity to sulfites.

Adverse food reactions may also be the result of a foodborne illness. Gastrointestinal symptoms caused by food poisoning may appear similar to those seen in allergic reactions. However, food poisoning reactions often affect more than one individual, and symptoms do not occur if the individual eats the (uncontaminated) food again.

Food Colors and You

Food colors help inform us about the taste and flavor of foods. They are evaluated and approved by several regulatory agencies for use in a variety of foods and beverages. Small and limited research associating food colors with adverse behavior among children has not been confirmed. While sensitivities among a small set of individuals can exist, consumers can make informed food choices by reading ingredient statements to confirm whether or not color additives are present in their food.

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www.foodinsight.org
January 2020

RESOURCES USED IN THIS DOCUMENT

- "ADHD Throughout the Years," The Centers for Disease Control and Prevention, 2019.
- "Adverse Food Reaction Is Not Always an Allergy," Rady Children's Hospital, 2019.
- "Code of Federal Regulations Title 21," U.S. FDA, 2019.
- "Food Additives," UK Food Standards Agency (FSA), 2019.
- "Food Colors," European Food Safety Authority (EFSA), 2019.
- "General Standards for Food Additives," CODEX Alimentarius, 2018
- "Color Additives History," U.S. FDA, 2017.
- "On the psychological impact of food color," Flavour, 2015.
- "The FDA Food Advisory Committee Explored the Relationship between Food Colors and Hyperactivity, and Here's What They Found," FoodInsight.org, 2011.
- "EFSA evaluates Southampton study on food additives and child behaviour," EFSA, 2008.
- "Food additives and hyperactive behaviour in 3-year-old and 8/9-year-old children in the community a randomized, double-blinded, placebo-controlled trial." The Lancet, 2007.
- "The Nature, Clinical Assessment, and Treatment of Children with Attention Deficit Hyperactivity Disorder (ADHD): A Review of the Literature," 2005.