



The color of low-fat cheese can have a significant impact on consumer perception, profoundly affecting the success of the product.

Image Source: Flickr user Andrew Blight

Over the past several decades, advances in our understanding of nutrition have dramatically transformed the dietary habits of millions of Americans seeking to improve their health, promote longevity, and resolve physical ailments. As the public has grown more health-conscious, the food industry has responded to increased [demand for healthier choices](#) by offering a host of alternatives to traditional products. Low-fat cheeses were amongst the first reduced-fat and fat-free products introduced to the mainstream market in the 1990s and, while they initially floundered owing to lack of gustatory appeal, advances in low-fat cheese formulation have created a surge in sales as cheese producers have discovered how to create more palatable products that simulate the sensory experiences of full-fat cheeses.

“In the last decade, cheese makers have been doing a much better job,” says Jed Davis, director of marketing at Cabot Creamer Cooperative. “Reduced-fat cheese delivers on the qualities customers expect in flavor, texture and mouthfeel.”<sup>1</sup> As demand for low-fat cheeses continues to grow, cheese makers are looking to both improve existing products and create new, more specialized low-fat alternatives. In fact, even some artisanal producers are beginning to recognize the potential of this market segment as our cultural focus on healthy living expands.

However, meeting customer expectations isn’t just about making cheeses that taste like their full-fat counterparts. As the saying goes, [we eat with our eyes first](#), and visual appeal is paramount to ensuring the marketability of a low-fat product. Thus, the color of low-fat cheese is of the utmost importance. Dr. Ranjeeta Wadhvani of Utah State University notes, “Before other flavor and textural properties of cheese can be noticed, the first parameter that distinguishes cheeses is color.”<sup>2</sup> Cheese producers often struggle to create products with coloration that approximates full-fat products, which many consider to be a key issue hindering the success of low-fat alternatives. As such, investigating the impact of low-fat formulations and fat replacers on cheese color has become a vital area of inquiry as researchers explore how to enhance the appeal of low-fat products.



Low-fat alternatives to full-fat cheeses have traditionally been limited to mass produced cheese products, but increased interest in healthy living is spurring even smaller cheese makers to offer reduced-fat options.

Image Source: Unsplash user Anita Peeples

#### The Impact of Color on Perception of Low-Fat Cheese

Milk fat is a critical part of giving cheese its color and opacity; it makes cheese look the way we expect it to. When milk fat is reduced, the color intensity decreases and the cheese takes on a more translucent appearance. Since the introduction of the first low-fat cheese in the 1990s, this has been widely acknowledged as a significant barrier to consumer enjoyment, regardless of the taste of the cheese itself. Until recently, however, no concrete data regarding the effect of color on low-fat cheese flavor perception and consumer acceptability existed.

That changed in 2012 when Dr. Wadhvani designed an experiment to investigate the relationship between color and consumer perception.<sup>3</sup> 120 panelists were asked to rate a range of full-fat and corresponding low-fat cheddar cheeses on a 5-point scale. The results showed that “among low-fat cheeses, color was shown to be important with consumer liking being negative influenced when the cheese appearance was too translucent or too white.” In fact, low-fat cheeses that were made the same way were ranked differently by the panelists based solely on the addition of color. Furthermore, Dr. Wadhvani discovered that the formulation of the low-fat cheeses was directly linked to likability and flavor perception; specifically, “matching the level of titanium dioxide with the annatto level” gave the most favorable results. The study confirmed what cheese makers have known for years: The color of low-fat cheese has a significant impact on consumer acceptance and recipes must be thoughtfully formulated to optimize appeal.



Spectrophotometric instruments can be used to perfect the color of low-fat cheese both in whole form and when cooked.

Image Source: Pexels user Peter Blech

#### Evaluating the Color of Low-Fat Cheese Formulations

The central role color plays in the perception of low-fat cheeses has led color to be one of the primary qualities evaluated during the formulation of new low-fat products. To obtain reliable color data, researchers examining the effects of fat replacers and other recipe variables use [advanced spectrophotometric instrumentation](#) that distills color information to  $L^*a^*b^*$  values for consistent, objective analysis. These technologies allow you to capture even the slightest color variations for a comprehensive picture of a product's chromatic qualities and directly correlate color to discrete ingredients or process variables. For example, a study published in the *Journal of Food Science and Technology* found that researchers used a [HunterLab Mini XE portable spectrophotometer](#) to examine the impact of using soy protein isolate (SPI) as a fat replacer in low-fat paneer.<sup>4</sup> The results found that the SPI had a noticeable effect on the color of the cheese and that the fat content of the paneer was directly proportional to the L value. Additionally:

The a and b values of SPI samples were higher than control. The SPI incorporation would have increased the amine compounds that react with aldehydes during Maillard reaction to form dark pigments (melanoidins). Values for a, which signify red (+) and green (-) and b, which signify yellow (+) and blue (-), increased with increasing levels of SPI incorporation, demonstrating that added SPI samples were more green and yellow colored. This could be attributable to the color difference between control milk (white color) and SPI (light brown color).

To create a truer visual match to full-fat cheese, these color differences could potentially be compensated for via the addition of colorants such as annatto and titanium dioxide. The data gained through spectrophotometric evaluation gives users the ability to easily determine whether or not a low-fat formulation matches its full-fat counterpart, both in whole form and when cooked, and carefully tailor recipes to create a suitable color match. If desired, cheese color may also be correlated to the [NCI National Cheese Standards](#).

Once a formula has been perfected and moves into production, spectrophotometric monitoring of color throughout the production process ensures that your product stays within your chosen tolerance range to optimize appeal and marketability. By instantly alerting you to undesirable color variations, you are able to easily prevent the release of aesthetically inferior products into the marketplace, preserving your brand reputation and guaranteeing that only products that meet your standards are introduced to consumers.

#### HunterLab Color Measurement

HunterLab has been at the forefront of color measurement technologies for over 60 years. Today, we offer a full range of portable, benchtop, and inline spectrophotometers to meet the needs of today's food industry, providing essential color analysis tools to suit both research and development and full scale production purposes. Our versatile lineup of instruments ensures that you are able to consistently obtain accurate, reliable, and repeatable color information to optimize cheese formulation and easily monitor production lines for the highest level of color quality control. [Contact us](#) to learn more about our cutting-edge spectrophotometers, advanced software packages, and world-class customer support services.

1. "Companies Work to Improve, Expand Reduced-Fat Cheeses," November 30, 2007, [http://www.cheesemarketnews.com/articlearch/cheese/30nov07\\_02.html](http://www.cheesemarketnews.com/articlearch/cheese/30nov07_02.html)
2. "Investigating the Strategies to Improve the Quality of Low-Fat Mozzarella and Cheddar Cheeses," 2011, <http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=2152&context=etd>
3. "Color of Low-Fat Cheese Influences Flavor Perception and Consumer Liking," May 2012, [http://www.journalofdairyscience.org/article/S0022-0302\(12\)00201-9/abstract](http://www.journalofdairyscience.org/article/S0022-0302(12)00201-9/abstract)
4. "Efficacy of Soy Protein Isolate as a Fat Replacer on Physico-Chemical and Sensory Characteristics of Low-Fat Paneer," August 2011, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3551177/>