

# Clean Label and Gluten-Free Breadmaking

Subjects: Food Science & Technology

Contributor: Monika Kajzer

“Clean label” is an evolving concept that has shifted in its meaning and significance over the years. This term is not regulated by food laws. However, it may be considered by manufacturers and consumers to be indicative of products that are, for example, organic, UTZ, Fair Trade, Halal, Kosher, vegetarian, vegan, and/or free from. The clean label is most strongly associated with “natural” ingredients that are easily recognizable and considered safe by consumers. Cleaner formulations are associated with shorter ingredient lists, as fewer ingredients appear to signify more natural and higher quality products. However, additives are often important for extending shelf life and improving the consistency and sensory qualities of food. Moreover, ingredients may be made from entirely natural source materials, but still not be considered suitable for use in clean label products.

Keywords: gluten-free bread ; clean label ; beta glucan ; psyllium ; transglutaminase ; gluten-free diet

---

## 1. Overview

The commonly used term of “clean label” refers to food products that do not contain additives (E numbers). Although there is not always a scientific reason for believing that additive-free products are healthier, clean label products are becoming more popular. The growing market for gluten-free foods represents an important target group of consumers, who could be interested in products meeting clean label standards. However, manufacturing gluten-free baked goods according to the clean label concept is extremely difficult, as gluten-free raw materials demonstrate poor baking properties. Additives are required to simulate the texturing properties of gluten, few of are suitable for clean label products. This paper discusses the possibility of replacing the hydrocolloids most commonly used in gluten-free baked goods with  $\beta$ -glucan, psyllium, or transglutaminase.

In recent years, consumers have taken a more active interest in the source, quality and nutritional value of food. This is reflected not only in the rising sales of organic products from certified crops, but also in calls from both consumers and consumer organizations to reduce or even avoid the use of additives in processed food. As a result, “free-from” statements have started appearing on products, which have been reformulated to make them closer to home-made or traditional recipes, with fewer ingredients.

## 2. Clean Label

“Clean label” is an evolving concept that has shifted in its meaning and significance over the years. This term is not regulated by food laws. However, it may be considered by manufacturers and consumers to be indicative of products that are, for example, organic, UTZ, Fair Trade, Halal, Kosher, vegetarian, vegan, and/or free from. The clean label is most strongly associated with “natural” ingredients that are easily recognizable and considered safe by consumers. Cleaner formulations are associated with shorter ingredient lists, as fewer ingredients appear to signify more natural and higher quality products. However, additives are often important for extending shelf life and improving the consistency and sensory qualities of food. Moreover, ingredients may be made from entirely natural source materials, but still not be considered suitable for use in clean label products. The term “natural” has no clear legal definition, and there are many non-synthetic additives on the food additives list that have been assigned E numbers. In the EU, a product labeled “no” (colors, preservatives, etc.) must not contain any of the substances covered by EU regulation no 1333/2008 <sup>[1]</sup>.

## 3. Consumer Attitudes

The word “clean” is itself hardly ever used on food packaging. The perception of “clean label” products varies depends on individual differences, culture, the type of product and its positioning <sup>[2]</sup>. Consumers link to “clean” foods such features as minimal processing and no preservatives, artificial sweeteners or artificial colors, or as being GMO-free. In recent times, the idea of clean label has evolved to also include sustainability and health. **Table 1** provides figures showing the growth of new food and beverage products launched with clean label claims. Clean claims can be divided into three categories:

“no added”, “natural/natural additives/organic” and “real”. “Real” seems to be a top claim only in the MEA (Middle East-Africa) region. Five out of the six fastest growing claims in North America belong to the “no added” category. In Latin America, that figure is six out of six. In Europe, the fastest-growing claim refers to “no stabilizers”.

**Table 1.** Growth of new food and beverage products launched with clean label claims, by region (CAGR 2017–2019) <sup>[2]</sup>.

North America	Europe	Asia	Latin America	MEA (Middle East Africa)	Australasia
No stabilizers (+48%)	No stabilizer (+116%)	No stabilizer (+56%)	No sweeteners (+22%)	No artificial color (+25%)	Nothing artificial (+42%)
No artificial sweetener (+30%)	No sweeteners (+24%)	No additives (+44%)	No flavors (+15%)	Real ingredients (+24%)	Only natural (+13%)
No sweeteners (+16%)	No colors (+18%)	No flavors (+33%)	No artificial additives (+13%)	No artificial flavor (+23%)	No artificial sweeteners (+9%)
GMO free (+15%)	Natural ingredients (+17%)	Natural sweeteners (+31%)	No artificial preservatives (+11%)	Natural colors (+18%)	Natural sweeteners (+9%)
No artificial preservatives (+12%)	No flavors (+17%)	No artificial preservatives (+30%)	No colors (+10%)	No artificial preservatives (+11%)	
Natural flavors (+10%)	Organic (+13%)	No artificial sweeteners (+26%)	No artificial flavors (+5%)		

Food products containing ingredients of natural origin seem to be especially attractive to consumers. In many countries, consumer behavior is strongly influenced by health considerations <sup>[3]</sup>. According to a 2014 study by the American non-profit organization Consumer Reports <sup>[4]</sup>, almost 60 percent of buyers look for the claim “natural” on packaging, believing that products labeled in this way are healthier than products without such a statement. Similar data can be found in a report prepared by Innova <sup>[2]</sup>. More than 50% of consumers surveyed in the United Kingdom considered natural products to be healthier. The same opinion was held by the vast majority of consumers in Mexico (above 80%). In the USA, 70% of consumers shared the same perception. Although the belief that additive-free products and unprocessed food are healthier does not always have a scientific basis, the clean label trend has spurred efforts to find acceptable alternatives to ingredients that are viewed negatively by consumers, which can provide the same processing functionalities, taste and texture.

### 3.1. Clean Label for Gluten-Free Baked Goods

The gluten-free baked goods currently available to buy are to a large extent based on starch blends or alternative wheat-free grains. These ingredients have different organoleptic values from those used in traditional wheat bread, and their taste is often considered unpalatable. Moreover, gluten-free baked goods have a lower nutritional value and the staling process is quicker than in traditional wheat bread. Gluten-free products are one of the most challenging food categories to formulate for clean label. Such aspects as availability of proper clean label raw materials, repeatability of recipes and processes as well as the economical focus of the solution need to be taken into consideration. Additionally, choosing ingredients that will imitate all the technological properties of gluten is a complex process. Gluten-free raw ingredients also exhibit poor baking properties, requiring the use of technological additives that mimic the texturing properties of gluten. At the same time, the target consumers are particularly conscious of the health and nutritional aspects of food. People on a gluten-free diet due to medical reasons are accustomed to paying more attention to food labelling. They need to check whether a given product may contain even minimal amounts of gluten, which may have an adverse effect on their health. Additionally, various manifestations of the disease make such people more aware consumers.

### 3.2. Health Premises for Gluten-Free Diet

Celiac disease is a lifelong autoimmune disease caused by a reaction to gluten. Symptoms of gluten intolerance include bloating, diarrhea, mouth ulcers, tiredness, anemia, osteoporosis, neurological or psychiatric problems and infertility. Occasionally, it can also manifest itself as a skin condition known as dermatitis herpetiformis <sup>[5][6]</sup>, which causes a red, raised rash, often with blisters. As the spectrum of symptoms is very broad, the diagnosis of celiac disease is not easy and involves a number of procedures. In 1969, the European Society for Pediatric Gastroenterology established

diagnostic criteria, which have been widely followed since by adult as well as pediatric gastroenterologists worldwide [7]. These guidelines are updated on a regular basis and a new version of the protocol was published in 2020 [8].

The only current treatment option for celiac disease is to adopt a gluten-free diet, avoiding cereals such as wheat, barley, rye, triticale, and in some cases oats (generally due to impurities containing gluten). While celiac disease is a well defined illness, there is perhaps less understanding of gluten sensitivity, which affects many people—who are said to suffer from non-celiac gluten sensitivity (NCGS) [9][10][11] or non-celiac wheat sensitivity [12]. Some consumers are also allergic to the proteins found in wheat. Many proteins are implicated in causing such allergies. The up-to-date version of the WHO/IUIS Allergen Nomenclature Database describes 21 well classified wheat allergens. Symptoms are triggered by the immune system a short time after ingestion of wheat. Some of the most common symptoms are similar to those associated with other common allergies, such as hay fever or pet allergies, but can also include stomach problems (diarrhea, bloating) and in serious cases anaphylaxis [6][13].

However, it has to be noted that strict gluten-free diet may not provide the recommended amount of essential vitamins and minerals. According to Grace-Farfaglia [14] an investigation of newly diagnosed Australian patients revealed that following a gluten-free diet after just a year can lead to a deficiency of such ingredients. This may cause further illnesses such as i.e., anemia or cardiovascular disease. Due to the fact that gluten-free breads present on the market, to a large extent, are based on starch blends, patients may also be more prone to obesity (exceeded body mass index). Another consequence of the diet is the change in diversity and composition of the intestinal microbiota (reduction in *Lactobacillus* and *Bifidobacterium* species) [14][15]. However, Melini et al. [15] observed that there is no worldwide nutritional profile of gluten-free goods. Differences between products manufactured in various countries are observed. Between brands and food categories the same phenomenon is being noticed. Products with a similar nutritional profile to that of conventional baked goods (containing gluten) are also available on the market.

Following a gluten-free diet is challenging for a number of reasons. Here, economic aspects (higher prices than gluten-containing breads), organoleptic aspects, less product choice both in shops and restaurants as well as time consumption, etc., should be mentioned. However, people who decide to follow the gluten-free diet for a variety of reasons, not always medical ones, find their symptoms, which most often include digestive problems, feeling unwell, and fatigue, to be alleviated.

### 3.3. Scale of the Problem

The incidence of celiac disease has increased several-fold in recent decades and is now estimated to affect around 1% of the world's population—1.4% based on serologic test results, 0.7% based on biopsy results. The frequency of this disorder varies with sex, age, and location [16][17][18][19]. In Europe, although some areas have a similar distribution of causal factors (Sweden, Finland, Germany), significant differences in the incidence of the disease have been observed, at between 2–3% and 0.2% of the total population [17]. Several factors are believed to influence the prevalence of celiac disease. The list of agents includes but is not limited to: population genetics, gluten exposure, feeding patterns, other environmental risk factors, increased wheat ingestion and infections early in life. However, the evidence is not yet conclusive. Increased disease awareness among both patients and physicians and advances in diagnosis may also be factors [9][20][21]. Between 0.5% and 6% of the population is estimated to suffer from non celiac gluten sensitivity. However, the definitions of the disease used in different reports vary widely and the data are unreliable [10]. The prevalence of wheat allergies varies from 0.1% to 4%, depending on the analytical method used, age, and region. It is usually estimated at around 1% [22][23].

The vast majority of people struggling with celiac disease are undiagnosed. For example, Coeliac Australia, the national organization supporting Australians suffering from coeliac disease, estimates that around 80% of local people having this disease remain undiagnosed [24].

---

## References

1. Regulation (EC) No 1333/2008 of the European Parliament and of the Council of 16 December 2008 on Food Additives. Available online: (accessed on 5 March 2021).
2. Report: Clean Label: Evolving and Expanding. Available online: (accessed on 5 March 2021).
3. Grunert, K.G. How changes in consumer behaviour and retailing affect competence requirements for food producers and processors. *Econ. Agrar. Recur. Nat.* 2006, 6, 3–22.
4. Say No to 'Natural' on Food Labels. Available online: (accessed on 5 March 2021).

5. Lebowitz, B.; Ludvigsson, J.F.; Green, P.H.R. Celiac disease and non-celiac gluten sensitivity. *BMJ* 2015, 351.
6. Ortiz, C.; Valenzuela, R.; Lucero, A.Y. Celiac disease, non celiac gluten sensitivity and wheat allergy: Comparison of 3 different diseases triggered by the same food. *Rev. Child Pediatr.* 2017, 88, 417–423.
7. Lebowitz, B.; Rubio-Tapia, A.; Guandalini, S.; Newland, C.; Assiri, A. Diagnosis of celiac disease. *Gastrointest. Endosc. Clin. N. Am.* 2012, 22, 661–677.
8. New Guidelines for the Diagnosis of Paediatric Coeliac Disease; European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN). Available online: (accessed on 5 March 2021).
9. Usai-Satta, P.; Oppia, F.; Lai, M.; Cabras, F. Motility disorders in celiac disease and non-celiac gluten sensitivity: The Impact of a gluten-free diet. *Nutrients* 2018, 10, 1705.
10. Catassi, C.; Bai, J.C.; Bonaz, B.; Bouma, G.; Calabrò, A.; Carroccio, A.; Castillejo, G.; Ciacci, C.; Cristofori, F.; Dolinsek, J.; et al. Non Celiac Gluten Sensitivity: The New Frontier of Gluten Related Disorders. *Nutrients* 2013, 5, 3839–3853.
11. Catassi, C.; Elli, L.; Bonaz, B.; Bouma, G.; Carroccio, A.; Castillejo, G.; Cellier, C.; Cristofori, F.; De Magistris, L.; Dolinsek, J.; et al. Diagnosis of Non-Celiac Gluten Sensitivity (NCGS): The Salerno Experts' Criteria. *Nutrients* 2015, 7, 4966–4977.
12. Aziz, I.; Lewis, N.R.; Hadjivassiliou, M.; Winfield, S.N.; Rugg, N.; Kelsall, A.; Newrick, L.; Sanders, D.S. A UK study assessing the population prevalence of self-reported gluten sensitivity and referral characteristics to secondary care. *Eur. J. Gastroenterol. Hepatol.* 2014, 26, 33–39.
13. Elli, L.; Branchi, F.; Tomba, C.; Villalta, D.; Norsa, L.; Ferretti, F.; Roncoroni, L.; Bardella, M.T. Diagnosis of gluten related disorders: Celiac disease, wheat allergy and non-celiac gluten sensitivity. *World J. Gastroenterol.* 2015, 21, 7110–7119.
14. Grace-Farfaglia, P. Celiac & Gluten Intolerance: A Wellness Perspective. *J. Nutr. Health Food Eng.* 2014, 1, 00028.
15. Melini, V.; Melini, F. Gluten-Free Diet: Gaps and Needs for a Healthier Diet. *Nutrients* 2019, 11, 170.
16. Aggarwal, S.; Lebowitz, B.; Green, P.H.R. Screening for celiac disease in average-risk and high-risk populations. *Ther. Adv. Gastroenterol.* 2012, 5, 37–47.
17. Catassi, C.; Gatti, S.; Fasano, A. The New Epidemiology of Celiac Disease. *J. Pediatr. Gastroenterol. Nutr.* 2014, 59, S7–S9.
18. White, L.E.; Merrick, V.M.; Bannerman, E.; Russell, R.K.; Basude, D.; Henderson, P.; Wilson, D.C.; Gillett, P.M. The Rising Incidence of Celiac Disease in Scotland. *Pediatrics* 2013, 132, e924–e931.
19. Singh, P.; Arora, A.; Strand, T.A.; Leffler, D.A.; Catassi, C.; Green, P.H.; Kelly, C.P.; Ahuja, V.; Makharia, G.K. Global Prevalence of Celiac Disease: Systematic Review and Meta-analysis. *Clin. Gastroenterol. Hepatol.* 2018, 16, 823–836.
20. Altobelli, E.; Paduano, R.; Petrocelli, R.; di Orio, F. Burden of Celiac Disease in Europe: A review of its childhood and adulthood prevalence and incidence as of September 2014. *Ann. Ig.* 2014, 26, 485–498.
21. Kupfer, S.S.; Jabri, B. Celiac Disease Pathophysiology. *Gastrointest. Endosc. Clin. N. Am.* 2012, 22, 639–660.
22. Nwaru, B.I.; Hickstein, L.; Panesar, S.S.; Roberts, G.; Muraro, A.; Sheikh, A.; on behalf of the EAACI Food Allergy and Anaphylaxis Guidelines Group. Prevalence of common food allergies in Europe: A systematic review and meta-analysis. *Allergy* 2014, 69, 992–1007.
23. Czaja-Bulsa, G.; Bulsa, M. What Do We Know Now about IgE-Mediated Wheat Allergy in Children. *Nutrients* 2017, 9, 35.
24. Coeliac Australia Home Webpage. Available online: (accessed on 23 June 2021).