Wheat-based Keto Baking

The keto (or ketogenic) diet is a fast-growing weight loss dietary trend that is raising the demand for low carb, nutritional-packed baked goods. With the market projected to reach revenues of 14.75 billion USD by 2027,[1] there is a growing space for bakers to innovate with keto products.

Keto baking replaces wheat flour with low-carbohydrate sources and other functional ingredients. This calls for use of alternative ingredients and processing methods. While removing flour is a quick way to cut carbs, there are wheat-based solutions for dough-based products such as:

- Breads / rolls
- Tortillas
- Pasta

Origin of the Keto Diet

Vilhjalmur Stefansso, an anthropologist (1925), started living off a meat-based low carbohydrate diet after his expedition to the Arctic. He believed this had significant health benefits and potential for future dietary research.

The diet was designed in the 1920s for treating refractory epilepsy in the US. Keto diet results in similar physiological effects as fasting. It reduces the incidence of epileptic seizures and controls it for a longer time.[2] This was mainly regarded as a field of dietary research until the 1970s when researcher Peter Huttenlocher devised and investigated the keto diet. A similar approach is followed by the Paleo and Atkins diets.

Walter L. Voegtlin published a book promoting the Stone Age diet based on foods available in the paleolithic era, succeeded by Loren Cordain's book, The Paleo Diet, in 2002.

Cardiologist Robert C. Atkins in the 1960s developed a low-carbohydrate eating plan known as the Atkins Diet. It primarily emphasizes protein and fat consumption. The diet follows a four-step approach:

1. Induction
2. Balancing
3. Premaintainance
4. Lifetime maintenance

Keto can often be gluten-free baking. This is because most wheat flour substitutes and ingredients used in the production of keto baked goods come from gluten-free sources that do not belong to any Triticum species and/or other potentially gluten-containing cereals. However, this paper will focus on wheat-based solutions.

Limitations & Solutions for Keto Baking

In the past, the baking industry has attempted to develop low and reduced-net carb bread. A frequent practice is to substitute wheat flour completely. Wheat gluten, an essential baking ingredient, is not a carbohydrate and can be used in keto baking. The simple sugars and starches are usually replaced by dietary fiber, proteins, alternative sweeteners, or water. The most common challenges in keto baking include differences in:

- Dough rheology
- Lower loaf volumes
- Crumb grain
- Texture
- Flavor
- More open crumb grain
- Tunneling (presence of holes)
- Gummy mouthfeel

LOW-CARB FORMULATION

Partial or complete replacement of the flour can help in successfully developing a formulation for low-carb products. The three crucial ingredients are:

1 PROTEIN

Protein addition is a popular choice. Neutral flavors such as wheat protein concentrates and isolates, dairy proteins, and soy protein are widely used. Wheat proteins can be used in keto bread applications to provide the “bread and dough” properties such as gas retention, texture, flavor, and crumb and crust characteristics.

Other proteins can provide properties such as water solubility, water holding capacity, emulsification properties, gelation, and whipping properties. Additionally, low carbohydrate goods often contain ingredients like nuts, flaxseed, and coconut flour.

LOW-CARB FORMULATION (cont.)

2 DIETARY FIBERS

Increasing the amount of fiber can compensate for the bulking properties of easily digestible carbohydrates while reducing the net digestible carbohydrates. It is crucial to evaluate for heavy taste and texture while using dietary fibers. Examples of dietary fibers include resistant starch, inulin, gums, flaxseed, soy, oat, barley, and wheat fibers.

3 ALTERNATIVE SWEETENERS

Alternative sweeteners compensate for the sweetness of sugars such as glucose(dextrose), fructose, maltose, lactose, honey, malt, and more. The high potency of these alternatives does not contribute to the bulk or provide higher calories. Sugar alcohols complement these bulking properties. The caloric contribution of these sugar alcohols are:[3]

Total calories from different sugar alcohols:

Sugar Alcohol	Calories	Sugar Alcohol	Calories
Erythritol	0.2	Mannitol	1.6
Isomalt	2	Sorbitol	2.6
Lactitol	2	Xylitol	2.4
Maltitol	3	Hydrogenated starch hydrolyzates	3

Total calories from different sugar alcohols

Sweetener	Sweetness Index	Sweetener	Sweetness Index
Sugar	1	Honey	1.1
Aspartame	200	Saccharin	400
Acesulfame K	200	Sucralose	650
Neotame	10000	-	-

Sweetness index = Times sweeter than sugar. Sugar = 1 Sweetness index.

KETO BREAD BAKING PROCESSING

- **Mixing:** High amount of wheat proteins in keto bread baking will require proper hydration and a longer mix time to fully develop the gluten.
- **Fermentation:** The baker needs to plan for additional time during the fermentation process because of the lack of sugar or other nutrients required by the yeast to leaven the dough.
- **Baking:** Monitoring the correlation between oven conditions (timing/ temperature) and microbial inactivation, crumb set, and color formation using thermal profiling can help manufacture a more consistent and desirable product.

How do you calculate the NET carb?

Dietary fibers are not considered a source of calories by the FDA.[4] Dietary fibers, with low-calorie values, can be used as a filler material. Dietary fibers can be subtracted from the total carbohydrates. The formula to calculate net carbohydrates is: Net Carbohydrates = Total carbohydrates - Fibers

References

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