



# Cookie Formulation & Production

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A favorite staple of the baking industry, cookie production represents a USD 30 million market. This market is expected to grow around 7.37% between 2020-2025. The current promising growth rate is accompanied by a change in the market dynamic associated with healthy baking trends.<sup>1</sup>

Consumers buying gluten free, organic, low sugar, low fat, high protein and high fiber baked goods have caused a drastic change in the cookie market, as well as an opportunity to meet these trends by implementing small formulation changes. Another factor contributing to the change of the market is the interest in developing a clean label.<sup>1</sup>

Current global consumption trends show that the biggest market for cookies includes North America and Europe. Companies worldwide rely on the development of novel products, with a special interest in healthier alternatives.<sup>1</sup>

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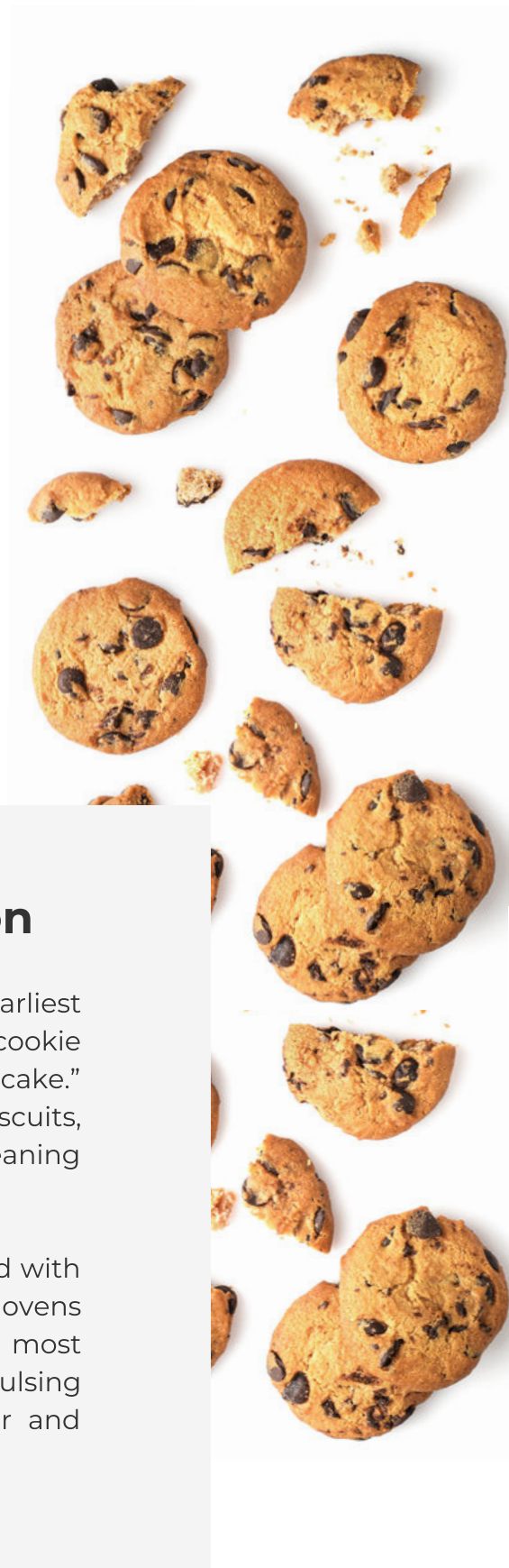


# What are cookies?

Cookies encompass a broad variety of sweet baked goods which are characterized by a high sugar and fat content, and a very low moisture content—usually below 4.0%.<sup>2</sup>

Cookies, or biscuits as they are known in the U.K, can be classified in five distinct categories:

- Hard-dough
- Semi-sweet
- Rotary-moulded
- Short-dough
- Wire-cut



## History of Cookies & Their Production

Cookies date back to around 7th century Persia, where the earliest form was a flat cake used to test oven temperature. The term cookie comes from the Dutch word Koekje that means “small cake.” Another word to describe this product in British territories is biscuits, which derives from the Latin expression panis biscotus meaning “twice baked.”<sup>2</sup>

Industrial production of cookies began in 19th century England with the development of the first mixing machines and mechanical ovens for continuous baking.<sup>2</sup> Today, cookies are one of the most consumed snacks in the world. Current health trends are impulsing the development of novel cookie formulations with cleaner and healthier ingredients.



# Cookie Formulation

*Commonly used ingredients in the production of cookies, and their function.<sup>2</sup>*

Ingredient	Type	Function
Flour	Low protein flour (all- purpose flour or cake flour)	Gives structure, absorbs liquids, aids in ingredients binding and provides substrate for browning reactions.
Fat	Butter, margarine or shortening	Imparts tenderness and mouthfeel, acts as dough lubricant to inhibit gluten development and reduce product toughness, helps with air incorporation during creaming and provides a rich, buttery flavor.
Sugar	Granulated white sugar, brown sugar or a combination of both	Gives sweetness, aids in fat creaming, contributes to cookie spread, and provides color through Maillard browning reaction. Coarse sugar granules makes chewier cookies while fine sugar results in a crispier texture.
Eggs	Liquid whole eggs, egg powder	Provides structure and flavor, acts as natural emulsifier, and contributes to Maillard browning reaction. Yolks impart unique color due to their carotenoid content.
Leavening agents	Baking powder, baking soda or ammonium bicarbonate	Produces CO <sub>2</sub> from chemical leavening reaction, tenderizes by stretching wall cells of baked goods (volume increase) and provides a fine crumb grain.
Salt	Granulated	Enhances flavor and taste.
Vanilla	Extract or fresh	Provides a characteristic sweet flavor.

Cookies can come with a wide variety of inclusions like chocolate chips, raisins, oatmeal, rainbow sprinkles, fruits, jellies, among others. Aside from these inclusions, other flavor agents such as almond or chocolate can be added to provide distinctive flavors and textures.



## Traditional vs. Healthier Cookie Formulation

The following table shows the formulation for a traditional cookie formulation versus an alternative one that uses chia flour to increase protein and lower carbohydrate content.<sup>3</sup>

	Traditional Chocolate Chip (% Dry Flour Weight)	Chia Flour Chocolate Chip (% Dry Flour Weight)
Cookie / Pastry flour	100	-
Cornstarch	-	100
Fat (all-purpose shortening)	50	-
Liquid whole eggs	33	68
Coconut oil	-	29
Granulated sugar	30	-
Brown sugar	30	-
Honey	-	49
Chocolate Chips	70	24
Benexia® Xia Powder 435 W LM	-	26
Benexia® chia seed LM	-	10
Cocoa powder	-	8.5
Sweetener (Sucralose)	-	8.4
Salt	0.75	-
Baking powder	0.75	2.5

When using chia flour or products, keep in mind that it reduces dough strength and extensibility and increases water absorption and the hardness of cookies.<sup>4</sup>



## ADDED PROTEIN & LOWER CARBS

Nutrition	Chocolate Chip Cookies	Chia Chocolate Chip Cookie
Carbohydrate	72%	53%
Fat	12%	16%
Protein	4%	7%

*Typical nutritional value of cookies per 100 g*



### MAKING COOKIES HEALTHIER

Traditional cookie formulations are high in saturated fats and simple sugars which readily increase the glycemic index, thus contributing to increasing the risk of suffering obesity and coronary and heart diseases.<sup>2</sup>

Healthier cookies can be formulated with some key ingredients that are known to promote gut health and lower the risk of heart disease by being good sources of fiber and omega-3.<sup>4</sup>

The development of keto cookies is quite simple due to the inherent nature and stability of the viscous mass of cookie doughs. Also, cookie systems do not rely on gluten development, and so will be less affected by the elimination of wheat flour. Be careful with the inclusions used as some of them may have a high sugar content.



## “ How can I use chia flour in my cookies? What are the benefits?

You can add chia flour at up to 10% of the total formulation or use the following substitution level:<sup>5</sup> Total substitution is chia flour: wheat flour, 1:1. In gluten free mixes, the ratio is typically 1:3. It is important to hydrate chia flour before use to increase the water holding capacity.

The use of chia flour provides several benefits, including texture modification, whole grain appearance and enhanced nutritional profile.<sup>4</sup>

## “ How can I make cookies crispy on the outside and gooey on the inside?

It is important to consider the type of sugar used in the formulation. A good mixture of both liquid and granulated sugar will provide a balance for sweetness and moisture. This allows the cookie to remain soft inside and crispy on the outside. Granulated sugar produces crispier cookies, while molasses with their slightly acidic profile and higher moisture content will provide a chewy texture.<sup>6</sup>

Baking temperature and time also influence the texture profile of the cookies. Baking at 160°C (325°F) and slightly increasing baking time will allow the cookies to spread out and cook slower while the edges will get crispier.<sup>7</sup>

## “ What causes chocolate cookies to go paler over their shelf life?

Chocolate cookies go pale due to the fat bloom. This is the migration of fat to the surface due to temperature changes. The best way to avoid this problem is to store cookies in a cold controlled environment or use a mixture of fats that do not have a steep melting curve.<sup>9</sup>



## “ What effect does changing or reducing the shortening content have in cookie formulation?

Fat plays an important role in cookie manufacturing. It provides a coating to inhibit gluten formation, thus toughening of the cookie. It also is key in the process of creaming. During this step, air is entrapped in a fat-sugar web that aids in leavening while improving texture and volume. If the fat (“shortening” in this case) is reduced, then there should be the addition of suitable emulsifiers, typically at a rate of 1.5% of the original fat weight. This will partially improve some of the functional properties lost from the decreased fat content.<sup>2</sup>

The use of oil, low solid fats or shortenings may cause several functional problems. They will not coat flour particles properly and their inability to cream to the same extent as solid fats will not provide appropriate mechanical leavening or aeration to the dough.<sup>2</sup>

## “ Can sucrose levels be reduced in cookie formulations, and what is the effect of using alternative sweeteners?

Sucrose plays several important roles in cookie production. First, sugar’s water holding capacity inhibits gluten development, and thus, the tightening of the cookies. Secondly, sugar aids in air entrapment during creaming. This is not possible with liquid sweeteners. Another important role of sugar is during baking. Sucrose produces a saturated solution by increasing temperature and providing spreadability to the cookie. During cooling, sugar content influences the final texture of the product due to crystallization.<sup>2</sup>

Reduction of sucrose due to health concerns is beneficial due to a potential decrease of calories. However, the functional properties of alternative sweeteners like sucralose provide a set of challenges due to their functional properties. Sucralose may significantly increase the sweetness of the end product if not used at the appropriate level. However, it doesn’t contribute to the browning of the baked product.



# References

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