

# **MADELEINES**

## **The Secret of the Perfect Hump**

**The Scientific Guide**  
**with Classic, Chocolate, and Vegan Recipes**

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Hi! I'm Katia Oldani, and today I'm bringing you into my laboratory, but with an eye toward Science, to unlock all the secrets of a timeless French pastry classic: the Madeleine. We'll go beyond the traditional recipe to understand how to achieve that pronounced, almost cheeky hump that's so popular on social media and in the displays of the finest pâtisseries. This isn't magic; it's pure chemistry and physics applied to the pastry arts.

## La Scienza nell'Arte Bianca

 Dolci, Pane e Pizza TOP



**KATIA OLDANI**  
 **BIOLOGIST PASTRY CHEF** 

## Who I Am: My Dual Soul

My path hasn't been the most linear one. I started with a degree in Biological Sciences, an experience that left me with a legacy of not only Science in my heart but also a method: the curiosity to understand the "why" behind things, to look inside ingredients to comprehend their transformations.

But it was in the pastry and baking laboratory that I found my world. It's here that this scientific curiosity merged with a passion for the White Art. My philosophy, if you can call it that, is very simple:

**"understand to do better".**

I believe, in fact, that a deep knowledge of raw materials is the first step toward achieving a result you can be happy with.

Today, with my "Ingredients Under the Lens" column and projects like "Monna Italia," what I try to do is simply share what I learn, hoping to promote a food culture that unites the wisdom of tradition with the awareness that science offers us. I love my work and consider it a great privilege.

## The Madeleine: An Icon Between History and Legend

Before we dive into the technique, a little history. Madeleines, with their unmistakable shell shape, originate from Lorraine in northeastern France. The most credited legend dates them back to the 18th century in Commercy, where a young peasant girl named Madeleine Paulmier supposedly prepared these little cakes for Duke Stanisław Leszczyński, father-in-law of King Louis XV. Their success was so great that their fame has never stopped growing since, immortalized also by the pen of Marcel Proust in his masterpiece, *"In Search of Lost Time"*.

The classic recipe calls for a batter similar to a *"quatre-quarts"* or a sponge cake, rich in butter: eggs, sugar, flour, and melted butter, often flavored with lemon zest or vanilla. But the true signature of a perfect Madeleine is its *"bosse"*, the hump..



## The Science of the Perfect Hump: It's Not Just Leavening

Achieving a tall, soft, and well-defined hump is the goal of every pastry chef who tackles Madeleines. This result doesn't depend on a single factor, but on a synergy of chemical and physical processes that we must learn to control with precision. The absolute star of the show is **"thermal shock"**.

### Thermal Shock: The Heart of the Process

The fundamental secret to a textbook 'bosse' (hump) is creating a violent thermal shock. The ice-cold batter must meet the scorching heat of the oven and the mold. Let's see how to orchestrate this clash of temperatures:

**Resting the Batter:** The batter **MUST** rest in the refrigerator. This is not optional; it is a crucial step. A rest of at least 12 hours is optimal. This not only allows the aromas to fully develop but, above all, serves to completely chill the mass and perfectly hydrate the flour's starch, giving a better structure to the finished product. The batter must reach a temperature of about 4-5°C.

**Frozen Mold:** While the batter rests, the mold must also be prepared. Grease it with soft butter (not melted) using a brush, lightly flour it, and then place it in the freezer for at least one hour before use. A metal mold, an excellent heat conductor, is preferable.

**Very Hot Oven:** Preheat the oven to a high temperature, usually between 220°C and 240°C (depending on your oven's power).

**What happens on a scientific level?** When we pour the cold batter into the frozen mold and bake it, the intense heat from the metal pan immediately seals

and cooks the outer part of the Madeleine in contact with the mold. While the outside solidifies, the heat penetrates toward the still-cold and almost-liquid center of the batter. The water in the batter (from the eggs and butter) rapidly turns into steam, and simultaneously, the leavening agents are activated by the heat. This gas, unable to escape from the already-formed crust, pushes forcefully upward—the only free direction—creating the characteristic hump..



## The Role of Leavening Agents: Chemistry at Our Service

The traditional recipe sometimes includes no leavening, relying only on the air incorporated into the eggs and the expansion of water vapor. However, for a modern, exaggerated, and reliable hump, the use of a chemical leavening agent is indispensable. But not just any one.

The most suitable one is **baking powder**, a balanced mixture of a basic component (usually sodium bicarbonate), one or more acidic components (like cream of tartar or monocalcium phosphate), and a starch for stabilization.

**Why is baking powder the right choice?** The most common ones on the market are "double-acting" baking powders. These release carbon dioxide (CO<sub>2</sub>) in two phases:

**First Action (cold):** A small amount of gas is released at room temperature, when the bicarbonate reacts with the first acid upon contact with the batter's liquids.

**Second Action (hot):** The majority of the gas is produced during baking, when the heat activates the second acid, which reacts with the remaining bicarbonate.

This second push, which occurs at the exact moment the thermal shock is happening in the oven, is what gives us the decisive thrust for an explosive and well-developed hump.

Using only sodium bicarbonate (baking soda), on the other hand, is not advisable in this preparation. Lacking a significant acidic ingredient (the lemon

juice alone is not enough to balance it), it would leave a soapy aftertaste (the so-called "soda taste") and produce a less fine and regular crumb structure.

**Pastry Chef's Percentage Quantities:** To achieve an optimal result, the amount of baking powder must be calibrated with precision. In professional pastry, we think in "Pastry Chef's Percentage" (Baker's Percentage), where the weight of the flour is set as 100%.

**Baking Powder:** The correct percentage for Madeleines is between **2%** and **4%** of the flour weight.

Practical example:

On 250g of flour, we would use 5g to 10g of baking powder.

**Too much leavening is counterproductive:** If the hump would grow too quickly, only to collapse back on itself, creating a crater and a coarse crumb structure.

## Ricetta Bilanciata per Madeleines dalla Gobba Perfetta

This recipe is designed to maximize thermal shock and yeast activity, two fundamental pillars for achieving our coveted "bosse."

### Important note:

Eggs should be weighed without their shells to ensure maximum precision in balancing liquids. The recommended flour is a weak flour (W 170-180), ideal for small pastries, to avoid excessive toughness of the dough.

### INGREDIENTE

Whole eggs (at room temperature)	150 g (25.42%)
Caster sugar	130 g (22.03%)
Unsalted butter (high quality)	150 g (25.42%)
00 flour (weak, W 170-180)	150 g (25.42%)
Baking powder	6 g (1.02%)
Fine salt	2 g (0.34%)
Zest of 1 untreated lemon	~2 g (0.34%)
<b>TOTAL</b>	<b>590 g</b>

**N.B.: Percentage of Total (%)**

## Recipe and Scientific Procedure for the Perfect Hump

Here is a summary of the procedure, analyzed step by step through the lens of the biologist pastry chef:

### Batter Preparation (Day 1):

Whisk the eggs with the sugar without incorporating too much air. We are not making a sponge cake; the goal is simply to dissolve the sugar.

Add the flour and baking powder (sifted together), folding gently from the bottom up. Keep mechanical action to a minimum to avoid developing the gluten network.

Incorporate the melted but tepid butter (around 45-50°C). If the butter is too hot, it will cook the eggs. Add the flavorings (e.g., lemon zest).

\* Cover the batter with plastic wrap, pressing it directly onto the surface, and **store it in the refrigerator for 12-24 hours.**

### Baking (Day 2):

\* Prepare the greased, floured, and **frozen** mold.

\* Preheat the oven in static (conventional) mode at **230°C.**

\* Take the batter from the refrigerator (without stirring it) and, using a piping bag, fill the mold cavities to about 3/4 full.

\* Bake immediately. Bake for about 4-5 minutes at 230°C. As soon as the hump has formed and the edges begin to brown, lower the temperature to 190-200°C and continue baking for another 4-6 minutes, until completely golden.

\* Remove from the oven and immediately unmold the Madeleines to prevent the residual heat from drying them out.

By following these steps, which combine tradition with a deep understanding of chemical and physical phenomena, your Madeleines will no longer hold any secrets and will proudly display a hump to rival those from the best pastry chefs in Paris..



## Madeleine with the Perfect Hump

This formulation is designed to maximize thermal shock and yeast thrust, two fundamental pillars for achieving our coveted “bosse.”

**Important note:** Eggs must be weighed without their shells to ensure maximum precision in balancing liquids. The recommended flour is a weak flour (W 170-180), ideal for small pastries, to avoid excessive toughness of the dough.

### Recipe Analysis:

- **Eggs, Butter, Flour (1:1:1):** The recipe is based on an almost identical ratio between these three structural ingredients, typical of rich cake batters. This balance ensures moisture, softness, and structure.
- **Sugar:** Slightly less than the other main ingredients so as not to weigh down the batter excessively and for a more balanced taste.
- **Baking powder:** Calibrated at 4% of the weight of the flour (6g of baking powder to 150g of flour), a dosage that provides the optimal lift for a pronounced dome without compromising the structure or flavor.

Remember that the success of this recipe lies not only in the ingredients, but also in the strict application of the technique described above: resting the dough in the cold and subjecting it to a thermal shock during baking. Happy baking!

And since pastry-making is a constantly evolving world, even a classic like the Madeleine can take on new and surprising guises. So let's explore two delicious and contemporary variations together: one with chocolate, intense and enveloping, and one that is 100% plant-based, to show that the science of pastry-making knows no limits and can produce perfect textures even without ingredients of animal origin.



## Vegan Madeleines (Without Eggs and Butter)

The most interesting challenge for a biologist-pastry chef is to reproduce a complex structure without its traditional pillars: eggs and butter. In this vegan version, each ingredient is chosen for its specific scientific function.

- **Egg Replacement:** A mixture of soy milk (for protein and liquid content), cornstarch (for structure and lightness), and the acid-base reaction between vinegar and baking soda, which creates an immediate leavening effect.
- **Butter substitute:** A good quality vegetable oil with a neutral taste (such as sunflower oil) to add moisture and softness without masking the flavors.

The result is a surprisingly soft, light Madeleine with a well-defined dome, proving that the chemistry of the ingredients is our best ally.

### Specific procedure:

1. In a bowl, sift and mix all the dry ingredients together thoroughly: flour, sugar, cornstarch, baking powder, baking soda, and salt.
2. In another bowl (or jug), whisk together all the liquid ingredients: soy milk, oil, apple cider vinegar, vanilla, and lemon zest.

3. Pour the liquids into the dry ingredients and mix with a whisk **just enough to obtain a smooth batter without lumps**. Overmixing will activate the gluten, making the madeleines chewy..

4. Even with this dough, it is essential to leave it to rest **in the refrigerator for at least 8-12 hours**. This will cool the dough due to the thermal shock and allow the starches to hydrate properly..

5. Proceed with baking as for the classic version, using a frozen mold and the double temperature gradient in the oven (230°C for the initial rise and 190°C to finish).



## Let's keep in touch!

I hope you enjoyed this guide to Madeleines and that it will be useful for your creations.

Sharing is at the heart of my philosophy, which is why I would like to continue dialoguing with you.

If you have any questions, curiosities, or simply want to chat about the art of baking (pastry and bread making), you can write to me at [info@katioldani.com](mailto:info@katioldani.com).

I will be happy to answer you..

## An evolution of the method: from chemistry to mathematics

The new publications I mentioned are now available.

If you found this guide useful, it is because we analyzed the chemistry and physics behind a result together. We have understood the “why” of ingredients and temperatures.

The next and complementary step, for those who want complete control over the creative process, is to master the Mathematics of the Art of Baking.

I am therefore delighted to present my two new books, dedicated to the fundamental pillar of balance.

You can find them:

- On my **Official Website** [www.katioldani.com](http://www.katioldani.com)

- On **Amazon:**



**[“Mathematics in the Baking Arts - BAKING Session: Guide to Calculation Methods for the Modern Artisan”](#)**

**[“Mathematics in the Baking Arts - PASTRY Session: A Guide to Calculation Methods for the Modern Artisan”](#)**

# Mathematics in the Baking Arts

Guide to Calculation Methods for the Modern Artisan

- BAKING session

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Biologist Pastry Chef



# Mathematics in the Baking Arts

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Inside these volumes, you will not find simple recipe books, but a **structured method** for understanding the formulas, proportions, and percentages that will allow you to build your recipes from scratch, with precision and scientific awareness.

**They are available now.**

**[Follow me on Amazon](#) so you don't miss out on my upcoming books or ebooks, and leave me a review (it's a small gesture for you, but a big help for me). Thank you in advance.**

## Let's continue exploring together

Finally, remember that, in the spirit of the **Monna Italia project**, all my work is always bilingual (Italian and English).

If you have foreign friends who love the world of baking and Italian culture, invite them to follow the page and get in touch with me. It could be the beginning of a new and exciting experience for all of us.

Thank you very much for your support.

See you soon,  
with passion and scientific rigor,

Katia Oldani  
Biologist Pastry Chef



**Happy Holidays from My Team!**



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