3-Day Fermented Pizza Versus Sourdough Pizza and Fermentation Times

By

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Abstract

Cold fermentation is a method of yeast proofing in pizza doughs in which the dough is rested in a refrigerator for 3 days. This process slows down the rate of metabolic reaction in the yeast, allowing for a slower and deeper development of flavor. The slower reaction rate also introduces more gas into the dough, creating a larger crumb and deeper brown in the cooked dough. While this process creates a superior dough, the three day process is inefficient and unrealistic for many home cooks. With this in mind, our goal is to create a viable alternative which is more achievable in the average kitchen. Our target time is around 12 hours, during which time the dough will be left unattended. To do this, we are going to use a sourdough style yeast, which is left in the fridge all the time, meaning that it will already be developed when dough production begins. We will measure the success of the new dough with the color of the dough and the air pocket structure inside. There is no clear way to measure flavor, but these other factors are usually indicative of flavor development.

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Research

Past research has revealed many different methods to reduce the fermentation time of pizza dough. Different ingredients such as different yeast strains and different starter cultures, and different methods of cooking have all been tested to compare to the traditional method of fermentation. Limongi, Simone; Simões, Deise Rosana Silva; Demiate, & Ivo Mottin (2012) conducted a study with a goal of reducing pizza fermentation time. This is what we are trying to accomplish. Their independent variables were the method of cooking, time and temperature. Based on studying the final pizza dough with a Chopin® rheofermentometer they found that time and temperature had a positive effect on the fermentation process. The release of carbon dioxide increased. The changes in time and temperature did not affect the traditional characteristics of a pizza which they defined as “soft pizza dough with bubbles and crispy edges and soft in the center”. From this study we are going to see how temperature and time affects fermentation, but also include different ingredients. Their definitions also give us a standard type of pizza that we are going to try to achieve in order to compare our own pizzas and our results to results of other studies such as this.

Fermentation occurs with micro bacteria (microflora). A study was conducted that tested 14 different starters with different microflora to see how they affected the fermentation process and pizza dough properties. They found that “starter cultures characterized by different combinations of yeast and lactic acid bacteria can promote the leavening processes, achieving the required increase in volume, producing doughs with different microbial contents and acidification properties but with similar rheological characteristics" (Coppola, Pepe & Mauriello,

1998). They concluded that microflora could lead to an expansion in pizza types available and especially, to improvements in the quality of industrially prepared products.

Improving the fermentation process would make it easier for businesses and people to produce pizza in a more efficient manner. Many pizza doughs are frozen before the proofing process begins. Pepe, Anastasio, and Villani (2005) studied the effects of a cryo resistant yeast strain with the goal of getting the same result after proofing of frozen dough compared to non-frozen dough. They found that by combining the use of cryo resistant starters and the refreshment of the thawed dough frozen dough had improved stability, and structural and mechanical characteristics that were similar to fresh dough than bread made from frozen dough without refreshment. This is important information to this study because it outlines research that's goal is to make pizza dough that is beneficial to businesses. Our goal is to improve the fermentation process so it will be more efficient for businesses and people who cook at home as well.

The dough recipe that we will be using as the base for our sourdough dough alternative comes from Joshua Weissman. Instead of the instant yeast used in many modern kitchens for pizza dough applications, this dough is based around a mature sourdough yeast starter. As this starter is already developed, it is more able to efficiently complete respiration. This respiration means that there will be greater gluten development, as well as more gas introduced into the dough. Higher amounts of gluten result in a more elastic dough, as the gluten is a crucial part of creating a dough that can stretch without breaking. The greater amount of gas in the dough will result in more air pockets in the final baked crust. These air pockets create a lighter, less dense dough. Dough browning is an indicator of both air introduction into the dough and gluten development, as thinner, more gluten-rich doughs brown and char, unlike more dense doughs

which tend to be completely even in color. We will also be using type 00 flour, which is an extremely fine, Italian flour. This flour type is used specifically for pizza dough and noodles, as the mixture of hard and soft flour granules allows the dough to maintain a chewy texture after cooking has finished.

While it is not the ideal cooking vehicle, we will use a standard indoor oven with a pizza stone. More classic pizzas use woodfire ovens, which can reach temperatures over 700 degrees fahrenheit, but as these are not common kitchen appliances, we will use a standard oven. The pizza stone holds heat, and stays at an extremely high temperature, which allows the undercarriage of the pizza to crisp more than something like a baking sheet which fluxes more in temperature. These are also more common and accessible to most home cooks.

Materials List

Tools	
Standard convection oven	
Proofing bowl	
Plastic wrap	
Towel	
3 day cold ferment recipe (control)	
Bread flour	250 grams
00 italian flour	250 grams
Active yeast	2 tsp
Salt	8 grams
Baseline Sourdough recipe	
00 Italian flour	655 grams

Whole wheat flour	45 grams
Mature sourdough starters	98 grams
Salt	14 grams
Water	490 grams
Toppings	
Basil	Desired amount (keep same for both pizzas)
Mozzarella Cheese	Desired amount (keep same for both pizzas)
Tomato sauce	Desired amount (keep same for both pizzas)

Procedure

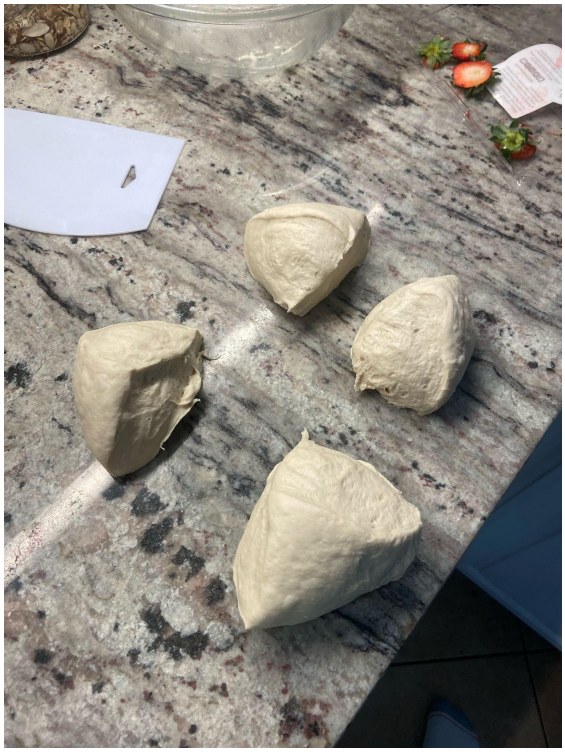
3 DAY FERMENTATION Procedure

Add bread flour, 00 flour, and yeast to a bowl. Mix together until homogenous. Add 1¼ cups and 2 tablespoons of room temperature water to the dry ingredients mix.

Add 1¼ cups and 2 tablespoons of room temperature water to the dry ingredients mix. Combine until the dough is shaggy. This stage is exemplified by a loose, uneven dough, where some areas are far more hydrated than others. The dough should still loosely stick together. Formation of this shaggy dough should take no more than 4 minutes. Cover with a towel or well oiled plastic wrap and leave to rest at room temperature for 5 minutes.

Knead the salt into the dough. Doing it now allows the salt to fully incorporate and leads to a better flavor. Dust flour over a clean countertop. Put the dough onto the floured workspace and knead until no dry clumps remain. It should take around 3 minutes for all dry ingredients to mix into the dough completely. This should leave an even and supple dough, which is less sticky to the touch. Pull the sides of the dough ball to the bottom to form a tight ball. When lightly indented, the dough should bounce back. Place the dough in a large, well oiled bowl and cover with oiled plastic wrap. Leave at room temperature for 12-24 hours.

Oil a clean surface and put the dough onto the oiled area.After oiling your hands, knead the ball for no more than a minute. The objective is to remove air from the dough, not to continue to work it, as overworking the dough will create a tough and less stretchy structure. Using a bench scraper, a common baking tool, divide the dough into four even pieces. Repeat the process of pulling the dough balls taught by pulling the edges to the bottom.



These dough balls can be placed into 4, well oiled, smaller bowls, or one larger, flat container. There should be about 4 inches of space between each ball. Cover with oiled plastic wrap or the oiled container lid and leave in the fridge for 72 hours.

After 72 hours, remove the containers from the refrigerator, remove the lid, and allow to rest at room temperature for one hour. In this time, the dough should relax and become more workable. When it is time to make the pizza, use both hands and gently pull the dough apart, while rotating it. This should form an even and thin circle. The desired thinness has been reached when “windows” begin to appear in the dough. “Windows” and extremely thin, translucent areas where light passes through the dough. They are also indicative of a successful dough as only well developed doughs with a sufficient amount of gluten development can form windows without tearing.

While the dough is being worked, place a pizza stone in the oven and preheat to 500 degrees fahrenheit. Pizza stones are flat ceramic circles which can conduct extremely high heats. This allows the extremely thin dough to become crispy. Put the dough onto a well floured pizza keel and add desired toppings. This experiment used tomato sauce, mozzarella, and basil. Slide the pizza onto the pizza stone and bake for about 11 minutes.

SOURDOUGH PIZZA Procedure

Use a fully mature sourdough starter. Feed the starter as usual and wait until it has fully finished rising, when it begins to fall slightly. Take 98 grams of the mature starter and add 490 grams filtered water, at 90 degrees fahrenheit. Mix until no large clumps remain. In a large bowl, separately, add 655 grams all purpose flour, 45 grams whole Wheat, 14 grams fine sea salt and mix to incorporate. After both bowls have been fully incorporated, pour the starter mix into the dry ingredients. Stir until a sticky dough forms.

To develop gluten, pick up dough with one hand and drop it down onto itself. Repeat for 5-8 minutes until a relatively smooth dough forms . Cover the bowl with a damp towel and allow it to sit in the oven with only the oven light on for 2.5 hours.

Three times during this wait, 30 minutes apart, remove the dough from the oven. Reaching into the bowl, pull a corner of the dough as high as it will stretch and pull it to the other side. Rotate 90 degrees and repeat 12 times. Replace in the oven when done each time.

After finishing in the oven, turn out onto a clean work surface, this time without flour. Lightly flour one hand and bench scraper. Hold the scraper in the unfloured hand, and slide it under dough, simultaneously rotating the ball with the free hand. Doing this allows the scraper to gently push the dough under itself. Repeat this until the dough is taught. Place the ball into an oiled large bowl with oiled plastic wrap. Place the bowl in the fridge for at least 7 hours.

When it is finished in the fridge, place the dough on a floured work surface and divide into 4 pieces. Pull corners to bottom repeatedly to bottom until a circular, taught ball forms. Place in a large flat container, oiled and ferment at room temperature for at least one houd. When it is time to cook, add toppings and bake at 500 degrees fahrenheit for about 9 minutes.


On the left the sourdough could stretch to where it is see through like the 3-day fermented dough but it contracted back when set down as seen on the right.

Results

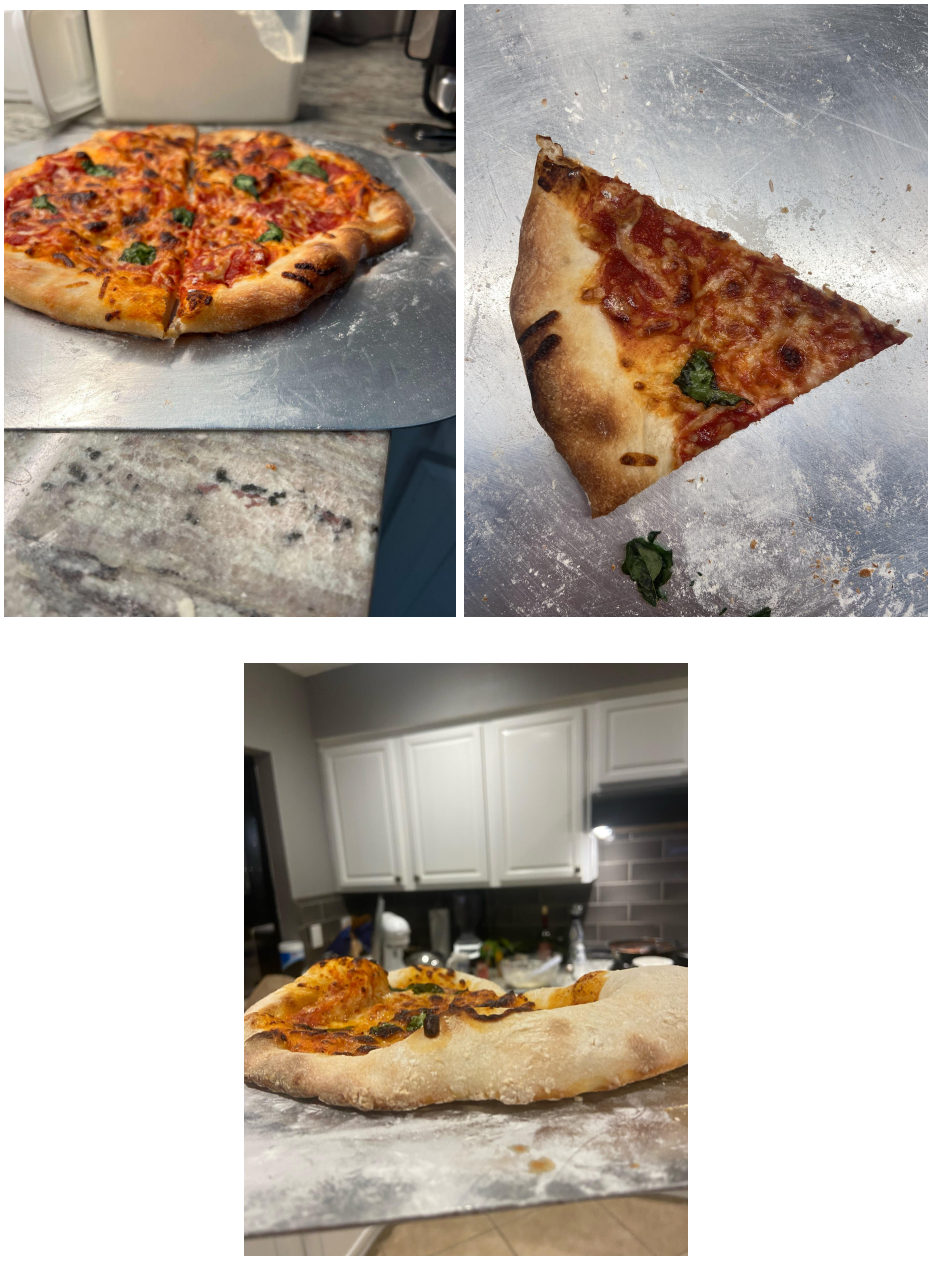
Dough (Softness):

The sourdough pizza came out tougher. Similarly to the 3-day fermented dough, it was able to spread to a window pane thickness, but it immediately pulled onto itself when placed on a flat surface. As a result of this condensing, the sourdough dough was denser and thicker.

Browning:

The 3-day fermented pizza came out unevenly brown like a traditional pizza. There are some dark and light areas as seen in the pictures. The sourdough pizza also achieved this uneven

surface. In spite of the thicker crust, this uneven browning occurred because there were still bubbles in the sourdough which created the rough texture needed for uneven charring.



Top left and right: 3-day fermented pizza, bottom middle: sourdough pizza

Elasticity before baking:

The 3-day fermented pizza is more elastic than the sourdough pizza before baking. The 3-day dough stretched easier compared to the sourdough pizza. Because the sourdough pizza did not hold its thin shape before baking, it was far thicker when laid on the pizza peel. This is most likely due to the time spent in the fridge. The fridge increases elasticity by allowing the dough to relax, and as a result the 3 day pizza dough was far more workable.

Height difference after baking:

The sourdough pizza was tougher and less elastic in the dough form, meaning that the sourdough pizza as a whole was thicker and taller. This is less desirable, as it means that the dough is denser and less airy. The crust was also thicker, which many people enjoy, but only as a result of it being difficult to stretch. It was also chewier than the 3 day fermented crust, which was tall only as a result of air pockets rising.

Left: 3-day fermented pizza, Right: sourdough pizza

Number/size of air pockets:

There were fewer air pockets in the sourdough pizza. It had 5 air pockets visible on the outside from one cross section, and the 3-day fermented dough had 8 air pockets visible. This is most likely due to fermentation time. More fermentation time leads to more bubbles building up in the dough, resulting in more air pockets. However, the sourdough pizza bubbles were larger because the dough doesn't stretch out as much as the 3-day fermented dough, meaning that there was more material for each bubble to grow.

Top view of 3-day fermented pizza

Stability after baking:

The 3 day fermented pizza dough was more stable compared to the sourdough pizza. As seen in the pictures below the 3-day fermented pizza slice starts folding further down the slice than the sourdough pizza slice, which starts folding almost right after the crust ends.

Left: 3-day fermented pizza, Right: sourdough pizza

Discusssion

The sourdough pizza did end up being a more efficient way of making pizza due to the low fermentation time required compared to a traditional 3-day fermentation pizza. However, the sourdough pizza does not match the criteria of a standard 3-day fermented pizza in all areas. In every important metric, the sourdough pizza was inferior. Some limitations we encountered that may have affected our results is our sourdough pizza dough starter started dying and this pushed back our timeline resulting in more of a rushed product. If this did not happen we could have spent more time on the sourdough pizza, getting it as perfect as possible, which may have led to a more comparable pizza to the 3-day fermented pizza.

Conclusion

Ultimately, the 3-day fermented pizza is a better pizza based on the criteria and characteristics derived from previous research discussed. However, the sourdough pizza is more efficient to make because of the significantly reduced fermentation time required. In the future it would be good to have more time to work on this so the confounding variables such as sourdough starter dying could be accounted for better. In addition to researching how to make the pizza production process more efficient, sourdough is known to be a viable alternative to regular breads for some people with gluten intolerance. Because sourdough starters exist for such a long time, they digest more of the gluten. This means that sourdough pizzas may be a way for people with gluten intolerance to eat pizza, but further research is required to see the viability of this option.

Acknowledgements

The recipe for our 3 day fermented pizza dough comes from Andrew Rea's cookbook: *Binging With Babish: 100 Recipes From Your Favorite Movies and TV Shows*. The recipe was adapted slightly. For our sourdough pizza, we used a recipe from Joshua Weissman's YouTube channel, adapted for the purpose of time to better fit our parameters. Both of these chefs have grown the online home-cooking community by posting intuitive content meant to teach newer home cooks, which was also a focus for our research in determining the viability of each different option.

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