SOURDOUGH DIGESTIBILITY

HOW SOURDOUGH CAN IMPACT BREAD BEYOND TASTE

whitepaper

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preface

Taste, authenticity, leavening, **digestibility**.

Let's talk about digestibility & bread. Did the last bread you ate give you a satisfied feeling? For how long? How you feel after eating a bread undeniably influences our appreciation of a bread. Based on extensive research by Prof. Gobbetti of microbiology at the University of Bolzano and Bari, Italy, this paper is an introduction to the topic of bread digestibility. New research by Prof. Gobbetti indicated that sourdough fermented bread can be easier to digest compared to breads started with Baker's Yeast alone. How come? And what does it mean for the baking industry? Those are some of the questions that we, together with Prof. Gobbetti, will address in this paper.

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RESEARCHING DIGESTIBILITY.

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3 WAYS OF YOU CAN EXPERIENCE BREAD DIGESTIBILITY. [3–5]

perception of appetite

As a staple food, bread should make you feel satisfied for a longer period of time. One aspect of a better digestible bread is that it releases its energy more slowly and steadily over a longer period of time, helping you feel satisfied for longer.

better digestion

nutrients

Bread is full of proteins and starch. But there's more to nutrients than quantity: 'Bio-availability' is the degree to which the nutrients are available for absorption. A more digestible bread doesn't have to have a higher concentration of nutrients, but a higher concentration of nutrients available for the human body to absorb.

longer satisfaction

gut sensitivity

Bloating, cramps or stomach pain can occur when bread consumption and/or some bread components such as gluten interfere with the activity of the digestive tract. Such symptoms occur when the gastrointestinal tract is filled with air or gas. Simply put, if you have a sensitive gut, this extra gas can cause discomfort. A decrease of gluten content would therefore help sensitive people to enjoy better digestion.

higher bio-availability

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FERMENTATION AT THE START OF BETTER DIGESTIBILITY.

To explore ways of optimizing bread's digestibility we returned to the very essence of bread, namely, the way it's fermented. With bakers typically choosing between commercial baker's yeast and sourdough, new research done by Professor Marco Gobbetti has shown that the latter not only impacts breads' volume, taste and texture, but also has a significant impact on its digestibility.

In his latest work, Prof. Gobbetti compared the digestibility of three types of bread, of which two were made with sourdough. The results confirmed what was already known empirically and partially proven by previous research: sourdough fermentation and more in general the longer fermentation process positively impacts the breads' digestibility. [6]

WHAT IS A SOURDOUGH?

Sourdough is a natural leavening agent for bread. It is made from three ingredients: flour(s), water (or other liquids such as juice, milk etc.) and two types of microorganism - lactic acid bacteria and yeasts. These are either airborne and / or present in the raw materials.

Puratos launched in 2013 the **world's only sourdough library**. Located in the village of St. Vith, 87 miles southeast of Brussels, the library today houses the world's most extensive collection of sourdough starters. Karl De Smedt lives this Quest for Sourdough every day. He is Puratos' dedicated 'Sourdough Librarian', traveling the world in search of old bread traditions and preserving the sourdoughs in the Puratos Sourdough Library since 2013.

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MEETING PROFESSOR MARCO GOBBETTI

Two decades ago Prof. Gobbetti started his work on fermentation and was at the time a pioneer in the field of microbial research. Today, Professor Marco Gobbetti is a world-renowned microbiologist. Gobbetti's team works across the globe, collaborating with scientists and Puratos, while researching the impact of fermentation in modern day breads. As Gobbetti states: in our labs "*we've the ability to ferment everythingferment everything*". But the goal of his work is already ". shifting and the near future will be a new focus on the role of sourdough fermentation on gut health.

Thanks to their common passion for sourdough, Puratos' path and that of Prof. Gobbetti crossed many years ago and they have not stopped working together. While Prof. Gobbetti was strengthening his knowledge and understanding of the microbiology world, Puratos created the Puratos Sourdough Library, which houses an amazing collection of traditional sourdoughs. This is a non-profit initiative and the sourdoughs remain the property of their respective owners. It's our way of contributing to the heritage of bread. Today, with over 1.300 different microorganisms isolated from these sourdoughs, we have a unique insight into the science behind breads' roots.

Prof. Marco Gobbetti
Free University of Bolzano, Italy

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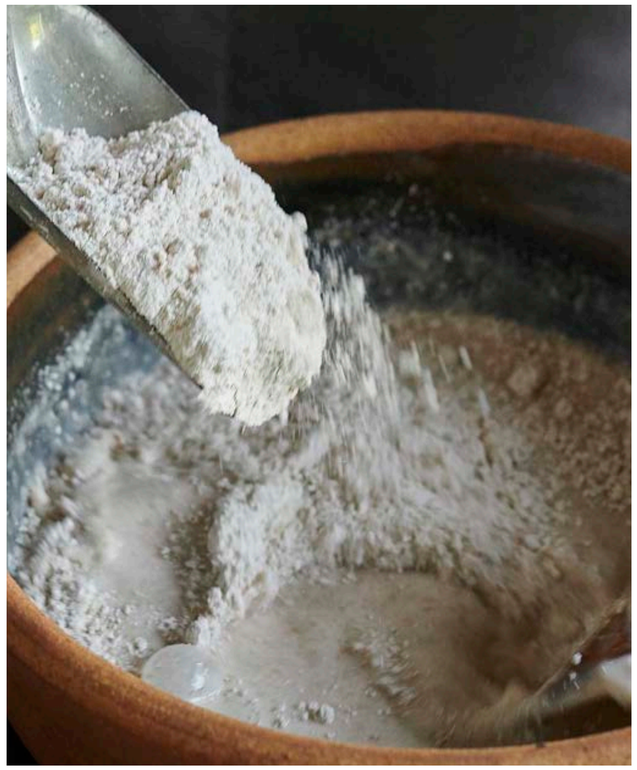
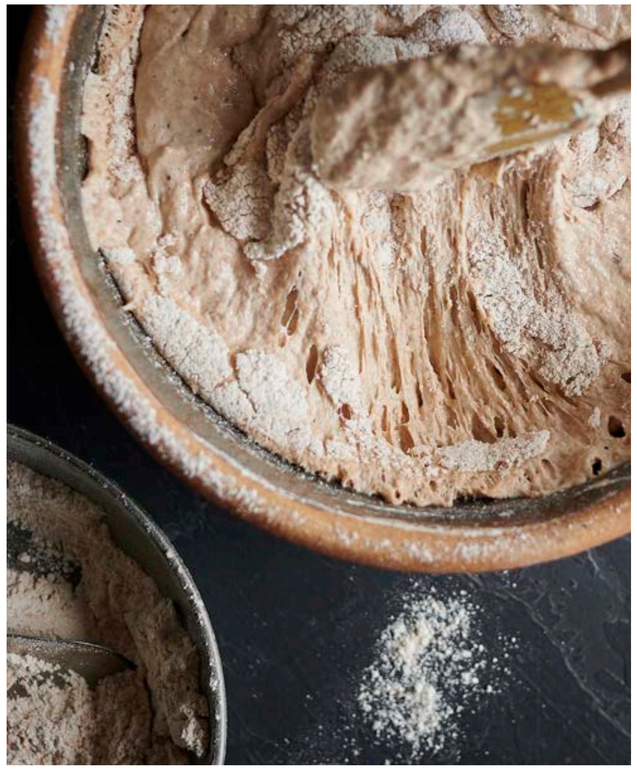




As proof of the strong connections between Prof. Gobbetti and Puratos, a Puratos Innovation Center has been built next to Prof Gobbetti's labs at the NOI Technical Park in Bolzano, Italy. Here, we work to create the 'Future of Bread' using traditional ingredients.

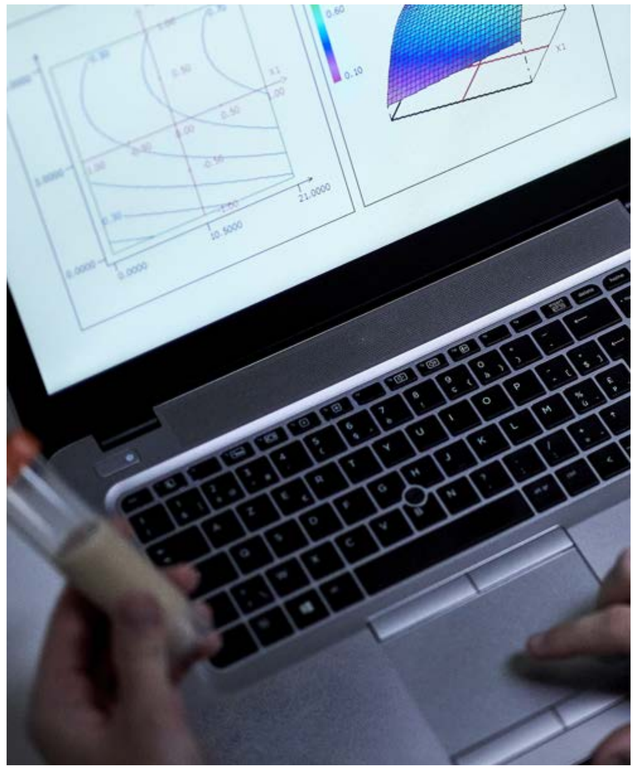
Prof. Gobbetti's labs at the NOI Tech Park have six laboratories dedicated to the research of the human gut microbiota and the development of products with special functional properties.

The professor's most recent research has focused on the comparison between regular yeast-fermented breads and sourdough breads. The results were very promising for sourdough, as Gobbetti confirmed, "*We carried out a human in vivo study showing that sourdough breads, compared to those prepared with baker's yeast bread, are more digestiblethose digestible*."."

HOW DO YOU RESEARCH FERMENTATION? Breads' traditional fermentation technology - sourdough - houses not only yeast, but also a huge variety of lactic bacteria. Today, modern technologies make it possible to do detailed research on these microbes. Gobbetti explains further: "*Fermentation is a traditional technique that started I don't know how many centuries ago. We now have all sorts of techniques that help us explain the secret behind fermentation. We've the ability to look into the interaction between microbes. We've the ability to better understand the microbes that are in a sub-dominant position. The techniques now give us the possibility to better understand this complex network and these metabolic interactions between microbes, which in my view is the secret of fermentation*."

HOW WILL THIS NEW RESEARCH IMPACT THE BREAD INDUSTRY? It is well known that sourdough brings taste to breads, but the professor sees the benefits of sourdough expanding beyond sensorial benefits. "*The future of sourdough fermentation research is to demonstrate how it offers advantages to human health from a nutritional point of view*."

WHEN WE ARRIVED AT THE LABORATORIES IN BOLZANO, PROF. GOBBETTI SHOWED US THE 'SHIME'PROF. SHIME' – a brand new simulator that models the human intestinal tract. Prof. Gobbetti explains that this equipment has taken his research to the next level. "*This equipment - the SHIME - can reproduce almost the same conditions as our human intestinal track … with the advantage that all the conditions are monitored. With it, you can study the effects of particular dietary habits, nutrients or foods, under standardized conditions. Currently we are using this equipment to confirm the better digestibility of sourdough bread compared to the baker's yeast bread and chemical-leavened bread. We're hoping to see whether sourdough may have an effect on the diversity and functionality of the intestinal microbiome of humans.*" It is clear that science is helping us to better understand the benefits of natural fermentation.



WHAT CHARACTERIZES SOURDOUGH?

A sourdough is mostly categorized by its microbial culture. Although consisting of just flour and water, its simplicity is deceiving. Thousands of different wild yeasts and lactic bacteria can thrive in it, each bringing their own characteristics. Sourdough breads typically have a longer fermentation then regular baker's yeast fermented bread.

IN WHAT TYPES OF BREADS IS SOURDOUGH USED?

Today, sourdough experts are able to produce sourdoughs for any type of bread, depending on the application, the flavour and texture characteristics the baker is looking for. Certain sourdoughs can, for example, highlight the butter notes in rich breads like brioche.

WHY IS SOURDOUGH IMPORTANT?

Historically, sourdough bread is important because it can be traced back to the ancient Egyptian civilizations that lived around 3000 BC. It is also important because sourdough bread is actually more nutritious than the grain from which it is made. Sourdough helps to release the nutrients and minerals present in the bread, making them easier to digest and more accessible to the body. Most of all sourdough improves the taste and flavour of bread.

FAQ

RESEARCH RESULTS

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HOW WAS THIS RESEARCH SETUP?

First, three industrial breads, fermented with either baker's yeast and/ or sourdough fermentation were baked. Then, thirty-six healthy volunteers underwent an in vivo challenge related to bread ingestion, while having their gallbladder, stomach, and oro-cecal motility monitored. SB, made with moderate sourdough acidification, stimulated more appetite and induced lower satiety. t-SB, with the most intense acidic taste, induced the highest fullness perception in the shortest time.

WHERE CAN I FIND THE FULL RESEARCH?

The research was published in December 2019, and can be found here: https://bit.ly/2ONLpaS (PDF download).

HOW WERE THE BREADS PRODUCED?

Industrial breads were manufactured at the pilot plant of ValleFiorita s.r.l. (Ostuni, Italy). Three types of bread (ca. 500 g each, all white flour) were manufactured. All breads were baked at 220°C for 30 min. Bread making was carried out in triplicate and each bread was analysed twice.

WHAT FURTHER RESEARCH WILL BE DONE?

Puratos is working on short- and long-term projects that will bring to the market high quality gut friendly ingredients to meet consumers' demand for even healthier breads. Research is focused on the optimization of breads' digestibility and the effect sourdough may have on the human gut microbiome.

FAQ

A few in vivo clinical studies have already demonstrated the effect of sourdough fermentation on starch digestibility. Compared to breads leavened with chemicals or baker's yeast, the digestible starch fraction of sourdough breads significantly decreased [7,8]. This in vivo research focusing on the overall sourdough bread digestibility, which strengthens or not the empirical and the in vitro scientific evidences, was still missing.

"SOURDOUGH FERMENTED BREADS ARE MORE DIGESTIBLE THAN THOSE STARTED WITH BAKER'S YEAST ALONE"

Gobbetti explains more, "*We demonstrated in a unique way that both the emission of gas during digestion, the transit of the bread in our intestinal track, and the absorption of nutrition, like free amino acids, that the sourdough bread was more digestible then all the other types of bread.bread*." Let's have a more detailed look at Prof. Gobbetti's latest research.

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Bakers Yeast Bread (BYB)	Sourdough Bread (SB)	Traditional Sourdough Bread (t-SB)
0% SOURDOUGH	**20% SOURDOUGH**	**20% SOURDOUGH**
1,5% YEAST	**1,5% YEAST**	0% YEAST
DOUGH PROCESS **2 hours on 30°C**	DOUGH PROCESS **1,5 hours on 30°C**	DOUGH PROCESS **4 hours on 30°C**
GLYCEMIA **HIGHEST**	GLYCEMIA **LOWER**	GLYCEMIA **LOWEST**
TRANSIT TIME **SLOWEST**	TRANSIT TIME **FASTER**	TRANSIT TIME **FASTEST**
FREE AMINO ACIDS **LOWEST**	FREE AMINO ACIDS **HIGHER**	FREE AMINO ACIDS **HIGHEST**

RESEARCH SET-UP

Three industrial breads were baked. A first one with just baker's yeast (BY). A second one with both baker's yeast and sourdough (SB). And a third one with just sourdough (t-SB). Three main factors were used to define and measure bread digestibility in an objective way: the perception of appetite, satiety and gastrointestinal symptoms after ingestion [2–4], and the bioavailability of proteins and starch.

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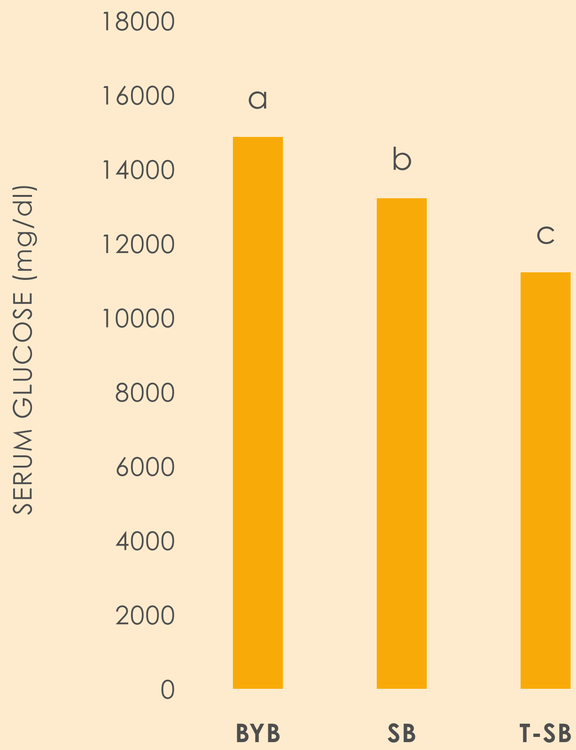
PERCEPTION OF APPETITE

First, we looked at the research results related to the 'perception of appetite'. Here, the Glycemic Index plays a role — this is the degree to which food raises our blood glucose levels either quickly, moderately or slowly. Prof. Gobbetti, "*Usually when I'm invited to conferences regarding sourdough fermentation, the decrease of the Glycemic Index is one of my main messages*."

WHAT MAKES SOURDOUGH AN INGREDIENT THAT CONTRIBUTES TO A LOWER GI-INDEX BREAD?

Sourdough contains, just like other fermented foods such as wine and yoghurt, lactic acid bacteria (LAB). These LAB cause the dough to acidify into varying flavours - from mild, creaminess to a real sour tanginess. It is this biochemical acidification that contributes to a lower GI-index. Prof. Gobbetti, "*If you ask me what the causes are of the decrease in GI-index, I can't properly answer your question because there are many causes. But all are related to the biological acidification. Nevertheless, the message that we should give to people is that if you consume a sourdough bread made with long fermentation you'll have a low GI index food*."

glycemia



In general slow is better when it comes to a bread's GI-index score. A low Glindex food means it releases its energy more progressively over a longer period of time and requires less insulin. In other words: our body needs more time to absorb slow sugars, meaning we don't feel hungry again as quickly.

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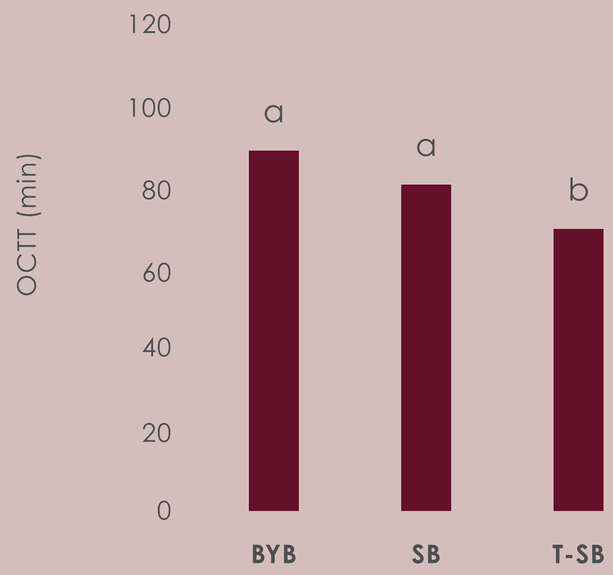
transit time



Research results: research showed that gallbladder response did not differ among breads, while gastric emptying was faster with sourdough breads. Oro-cecal transit was longer for BYB and faster for sourdough breads, especially when made with traditional and long-time fermentation (t-SB). In this case transit lasted ca. 20 min less than BYB. [6]

GUT DISCONFORT

‘Gastrointestinal symptoms’ such as feeling cramps or bloating or other pain after ingestion occurs when the gastrointestinal tract is filled with air or gas. People with a sensitive gut have a higher than normal tendency of developing this extra gas and therefore discomfort, after eating a meal. Interestingly, even though people feel “full” for a longer time, sourdough bread doesn’t occupy the digestive system for a long time and therefore does not make the digestion process a long and laborious affair.

HOW CAN WE MAKE BREAD MORE APPEALING FOR PEOPLE WITH SENSITIVE GUTS? Prof. Gobbetti explains that there are a number of disorders and intolerances related to eating gluten, often causing symptoms like bloating. “*Except for celiac disease, where you need a complete removal of gluten from the diet, a decrease in the amount of gluten consumed would help people have a better digestion. What people need to know is that during sourdough fermentation there is decreased gluten content, and an increase in the free amino acids, which helps the digestion of the bread.*” Comparing the gluten content between the three breads in the research, we can see a significant difference in gluten content between the BYB and the t-SB. The BYB had a gluten content of 8.9, SB 8.7 and a significantly lower 7.6 gluten content was recorded for the t-SB bread.

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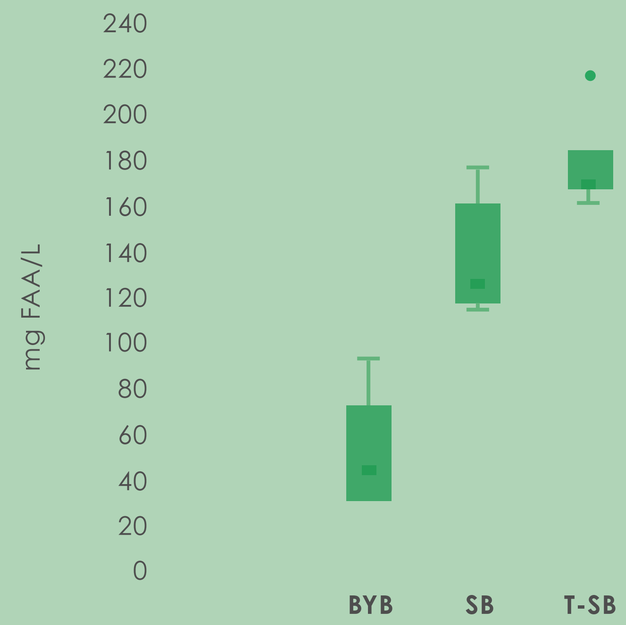
NUTRIENTS

Prof Gobbetti: "*One term that we've become used to in nutrition is bio-availability. It means that the most important thing in bread is not the content of vitamins, minerals, or free amino acids, but their bio availability for absorption by humans*."

"If you want to produce a bread having a higher bio availability of minerals, of free amino acids and of proteins, you need to decrease the pH level to activate phytase, which degrades phytic acids and makes free amino acids, minerals and proteins."

The importance of fibres in a healthy diet is well known. Consuming bread as a source of fibres is a great start. But dietary fibre comes in different kinds, each having a unique role in nutrition. Prof. Gobbetti explains more, "Many of the recommendations we receive are to increase the consumption of fibres. But these fibres decrease the sensory and in some cases the rheological properties of the bread or other baked goods. The only way to exploit the potential of fibres is to use sourdough fermentation, which will increase the availability of fibres and will increase the sensorial properties, thus enabling humans to increase their consumption of such types of baked products."

free amino acids



Research results: the graph above shows the concentrations of total Free Amino Acids (FAA) in the blood plasma of volunteers across the three breads. The concentration of FAA between the sourdough breads is slightly higher, but not signifificantly so compared to BYB. 120 minutes afffter ingestion, the diffffference however becomes clearer. Graph B shows that the total FAA in the blood plasma of candidates who ate sourdough breads remained high, whereas the FAA in blood plasma from participants who ate BYB decreased by 67%. The conclusion is that sourdough breads deliver a FAA concentration that remains higher for a longer period of time. [6]

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The Center for Bread Flavour

Based in Saint Vith, Belgium, the Center for Bread Flavour combines our expertise in taste, flavour, fermentation and bread pairing to show you how sourdough influence the taste and texture of bread.

Creating your own rustic style bread range takes time, and involves sharing insights, exploring new recipes and partnering on your product development. Our aim is to work with you to create rustic-style finished goods with taste beyond imagination, and bake until your rustic style breads exceed both your and your consumers' expectations.

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