HOW SOURDOUGH CAN IMPACT BREADS DIGESTIBILITY

THE FUTURE OF BREAD LIES IN ITS PAST

SOURDOUGH & DIGESTIBILITY

HOW SOURDOUGH CAN IMPACT BREADS DIGESTIBILITY

Puratos
Reliable partners in innovation
Let’s talk about digestibility & bread. Did the last bread you ate give you a satisfied feeling? And if so, for how long? These are undeniably experiences that influence our appreciation of bread. Based on extensive research by a professor 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.
HEALTHY BREADS ON THE RISE.
HEALTHINESS IS NO LONGER JUST ABOUT REMOVING INGREDIENTS.

Bread can be considered a staple food, as it has been a vital part of most diets for centuries. Millions of people rely on bread to obtain the essential calories and nutrients that they require on a daily basis. Consumption habits are changing however, particularly as people’s awareness of digestive health is gaining importance. This is leading some to search for new bread recipes, or to avoid the carbs and gluten to be found in bread - even when no medical reasons exist.

Consumers strongly relate sourdough to healthiness. ‘Bread with sourdough’ has become one of the favourite bread during the Covid crisis - 3rd after ‘bread rich in fibre’ and ‘breads with more grains’ and preferred over ‘high in protein, low in salt’ and ‘gluten free’ bread. [1] These new consumer needs raises the following questions: how can we make breads more digestible, healthier and still appealing to everyone?
HOW IMPORTANT TO YOU IS YOUR DIGESTIVE HEALTH?*

* % that answered ‘very’ or ‘extremely important’

66% EUROPE

65% NORTH AMERICA

81% SOUTH AMERICA

WHY DIGESTIBILITY?

Your digestive system breaks down food into its chemical components - carbohydrates, fats, proteins, that the body then absorbs and uses for energy. This digestive flow doesn’t always run smoothly. Various factors - what we eat, and how we eat - can disrupt digestive health. On the other hand, certain foods are more digestible than others, and can help us to maintain a healthy digestive tract.

The digestive system - from the mouth to the colon - is actively involved in the entire journey of food through the human body. The gut is the final part of this digestive system. It has long been known that microorganisms in the human gut play an important role in digestive health. Now, recent research indicates that gut bacteria may impact wider aspects of health, including obesity and metabolic health. Given the mounting body of evidence that links gut health to overall health and well-being, it shouldn’t come as a surprise that consumer awareness on this topic has been rising over the past few years. Already in 2018, about 78% of the global population considered digestive/gut health to be very or extremely important [2]: and, now, following COVID-19 lockdowns, gut health has moved to the top of people’s health agenda.
Our Health and Well-Being commitment

Following Puratos’ Health & Well-Being commitment to “provide consumers with outstanding products that help them enjoy a healthy diet and fulfil their well-being needs” we started developing a product range that supports the digestive health of the final consumer. We are delighted to announce that a new product based on established technologies is just few months away.

We have called this new product range the “Happy Gut” range and expect all bakery products that become part of this portfolio to contain gut health promoting compounds (fibre for example), which support consumers’ gut health status.
HOW YOU CAN EXPERIENCE BREAD DIGESTIBILITY IN 3 WAYS: [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.

**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.

**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.
RESEARCHING DIGESTIBILITY.
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]
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 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.
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 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’** – 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.
FAQ’s about Sourdough:

WHAT IS 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.

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 than 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.
RESEARCH RESULTS.
FAQ’s about the research:

**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.

“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.

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.” LET’S HAVE A MORE DETAILED LOOK AT PROF. GOBBETTI’S LATEST RESEARCH.
THREE INDUSTRIAL BREADS WERE BAKED

- First one with just baker’s yeast (BYB).
- one with both sourdough & Bakers Yeast (SB).
- Third one with just sourdough (t-SB)

THREE MAIN FACTORS CAN BE 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.
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.”

In general slow is better when it comes to a bread’s GI-index score. A low GI-index 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.
**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.

Research results: Glycemia was assessed by analysing the concentration of glucose from blood samples that were collected after meal ingestion. All breads showed peaks of serum glucose concentration between 40 to 60 min after ingestion. The peak following BYB ingestion corresponded to 14.3 +/- 0.39 mg/mL, which was ca. 5% lower (p < 0.05) than those reported for SB and t-SB. Compared to BYB, SB and t-SB generated a lower glycemic curve. [6]

![Transit Time Graph](image_url)

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]
Free Amino Acids

A = 60 minutes  B = 120 minutes

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 significantly so compared to BYB. 120 minutes after ingestion, the difference 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]

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.”
JOIN THE TRADITION.
HOW TO WORK WITH LONG SOURDOUGH FERMENTATION?

Baking premium ‘old fashioned’ sourdough breads in industry comes with all sorts of added complications and so many things to think about, including: food safety of long fermentations, a shortage of skilled labour, space, time, consistency, quality, cost of goods and sale price. Successfully baking — and launching — your sourdoughs breads is a challenge that incorporates many facets.

In conclusion, it is possible to control every facet of this process when preparing long fermented sourdough breads using the industrial baking process. Our range of Sapore sourdoughs delivers the tradition of sourdough while letting you create breads with your own flavour profile, appearance and story. And an extensive range of cleaner label Bakery Improvers makes it much easier to meet consumers’ expectations on texture, tolerance and freshness.

WHAT TO BAKE?

You can develop both crusty and soft classics from the past, like baguettes or good old fashioned burger buns. Typically long fermented sourdough breads come with a rustic look of the crust, and with a more open crumb that has a cohesive, moist and elastic-like texture. It’s the result of a longer fermentation process and higher hydration dough, fermented with sourdough. Achieving this ‘waxy’ textured, tasty bread is a delicate balancing act between the right processes and ingredients.

During fermentation, the dough is naturally filled with gas to create a consistent, open structure that’s full of flavour. Here, temperature and time control is vital with more rustic bread characteristics as you ferment longer time. Once the dough is fully fermented, it is important that it is handled very carefully. To deliver handmade style breads, bakers must adapt their baking technologies to the handling of stickier, more gaseous, long-fermented dough.
WHAT TO COMMUNICATE?

SOURDOUGH COMMUNICATION:
Consumers strongly relate sourdough to healthiness. ‘Bread with sourdough’ has become one of the most favourite bread during the Covid crisis – 3rd after ‘bread rich in fiber’ and ‘breads with more grains’ and preferred over ‘high in protein, low in salt’ and ‘gluten free’ bread. [1]

To successfully create a healthy halo for sourdough, it’s important to match your communication with local cultures, as just like bread itself, sourdough perceptions vary by culture. Research has shown that in many countries, e.g. Italy, there is no link to ‘sourness’ and so words related to ‘sour’ should be avoided. In other countries that are less familiar with sourdough, such as the United Kingdom, a link to ‘naturalness’ works better. Countries like Spain and France where there’s a better understanding of the ingredient, offer an opportunity to talk more in detail about sourdough and use words like ‘bacteria’ and ‘(long) fermentation’. [9] If you are interested to know the recommendations for your country, reach out to your local Puratos representative.

TALKING ABOUT HEALTH
It is important to remember that local regulatory situations don’t always match scientific findings. In some countries, sound scientific evidence published in peer-reviewed journals is required to back up package health related claims. In other countries, these claims can only be used if they match health claims criteria approved by local authorities.
LONG FERMENTED BREAD RECIPE

INGREDIENTS

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flour (tradition)</td>
<td>100</td>
<td>1000</td>
</tr>
<tr>
<td>Water</td>
<td>+/-68</td>
<td>+/- 680</td>
</tr>
<tr>
<td>Salt</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Sapore Alcina</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>O-tentic Tradizione</td>
<td>4</td>
<td>40</td>
</tr>
</tbody>
</table>

MIXING

mixing spiral

Add the flour, 60% water, Sapore Alcina and O-tentic Tradizione to the mixer. Don’t add the salt yet.

mix 12 min 1st speed, add salt in 11th minute.

After 12 min. add remaining +/-8% water - 5 min 2nd speed.

dough temperature       25°C to 26°C
bulk fermentation        60 min. ambient temp. Fold and give it an additional 30 min. rest.
scale                     Scale on 900gr (or desired weight)
intermediate proof       30 min. ambient temp.

MAKE UP

shape
final fermentation
decoration before baking

round
Overnight (12 hours) at 10°C.
Flour and cut.

BAKING

before baking
oven temperature
total baking time

30 min. rest on room temperature
250°C with steam for 5 min. drop to 220°C bake 45 min
50 min.
In the slowest processes, carefully selected yeasts and lactic acid bacteria ferment diverse flours like rye, wheat, spelt and oats into a wide variety of Sapore sourdoughs. Sapore is Puratos’ range of stabilised/dried sourdoughs - for taste - and fresh, living sourdoughs - for taste, texture and better long-fermented breads. To support the return of local bread traditions, Puratos offers customers across the world locally produced Sapore sourdoughs, made with local flours.

This is as good as it gets if you want traditional sourdough. Our sourdoughs are low in acidity, which means you can incorporate more fermented flour in your bread recipes. The result is a more complex flavour profile, as well as a positive impact on the freshness and associated health perception in your final applications.

Our range of Sapore sourdoughs

Our flavours... Your taste

By mixing lactic acid bacteria and flour, combined with different production processes, Puratos produces a wide selection of different flavours that can be clustered into 6 categories, as illustrated in the windmill blades here on the left.

- FERMENTED: yeast-alcohol
- CREAMY: fresh butter, fermented milk, cream
- MAILLARD: toasted grilled, smoky, wooden, caramel, grilled coffee
- MALTED: malt syrup, malt flour
- FRUITY: apple, raisins
- SOUR: lactic, acetic
Traditional fresh living wheat sourdough based on lactic acid bacteria and yeasts for all sorts of breads. Sapore Alcina lends volume, cereal notes, and slight acidity to your bread.

Fresh rye sourdough for wheat & rye breads. Oracolo is designed for any kind of traditional sourdough bread.

A fresh wheat sourdough based on the panettone starter culture is designed for sweet bakery products, such as brioche, Italian Panettone, sweet dough breads, viennoiserie and Danish.
O-tentic, at the start of long fermented bread

Based on natural fermentation, O-tentic is the start of exceptional breads full of taste, flavour and texture. Achieving great long fermented sourdough breads is a delicate balancing between precision and craft. To regulate the fluctuations in fermentation power in living sourdough, O-tentic delivers consistent fermentation power in your recipe and supports the extra careful handling of the stickier, gassy long-fermented doughs, resulting in high quality breads, every single time.

O-tentic Tradizione

O-tentic Tradizione is based on a Durum sourdough, and is the perfect ingredient for your long fermented sourdough breads. It contains - like sourdough itself - active yeasts and lactic bacteria.
Sprouted Grains, health & taste

Puratos Sproutgrains are wholegrains that have been sprouted and then slowly fermented, giving them a unique taste and texture. Sprouted Grains are synonymous with health and taste. Our unique process (sprouting and fermentation) makes these grains reportedly easier to digest. Enzymes contained into the grains are turning complex molecules into simpler ones that are easier to digest.

Sproutgrain
Wheat, Oat & Rye

Puratos Sproutgrain are wholegrains that have been sprouted and then fermented, giving them a unique taste and texture.
REFERENCES & DISCLAIMER


2. HFI, Global Trend Study 2018


9. Consumer research FEDIMA ‘Understanding the consumer towards sourdough and sourdough bread’ May 2019

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Create your Future.

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