fermentlife®

REPORT

Highly bioactive postbiotic and parabiotic turmeric obtained by targeted fermentation

INTRODUCTION

Demand for natural nutrition products that offer preventive and therapeutic benefits is a global trend. It's also one of the best strategies for reducing the enormous costs of healthcare facing societies across the world.

Scientific studies and publications are increasingly showing tremendous potential for probiotic and postbiotic effects. A key area of interest for these products' targeted effects is long-term gut health, as this is an essential factor in maintaining overall health.

Turmeric is one of the best researched and most scientifically evaluated plants with strong gut-health potential, and is therefore an excellent candidate for functional food and supplements to support gut health.

By combining it with fermentation – one of the most ancient and natural processes for refining raw plant materials – turmeric's potential can be further increased many times over.

When developing parabiotic and postbiotic turmeric, we focused on the following key areas:

- Realization of a bioactive, full spectrum matrix with a synergistic composition focused on intestinal health
- Fermentative predigestion of the poorly available curcuma matrix
- Significant enrichment of the matrix with functional, health-related fermentation metabolites for optimal postbiotic efficacy
- Production of significant high bacterial concentration for strong parabiotic effects
- Creation of a new sensory profile and better solubility

This report demonstrates the general health potential of turmeric and discusses the fermentation-induced enhancements to its bioactivity achieved by fermentlife's turmeric development programme.

TURMERIC – HEALTH IMPACT MEDIATED BY THE MICROBIOME

Turmeric is the yellow-orange rhizome of *Curcuma longa L.*, a highly resilient plant belonging to the ginger family (Zingiberaceae). It is mainly cultivated in Asia but also grown in South America and some parts of Africa. In addition to its culinary and dyeing applications, turmeric has long been valued for its health benefits within both Ayurvedic and traditional Chinese medicine.

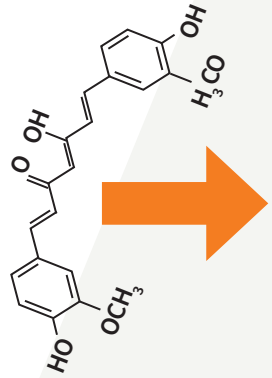
A unique matrix of bioactive, secondary plant compounds

Curcuminoids are the most significant bioactive constituents to have received in-depth scientific attention to date. They include the compounds curcumin, demethoxycurcumin and bisdemethoxycurcumin, along with other minor curcuminoids such as tetrahydrocurcumin. But the complex matrix offers even more valuable substances.

These include flavonoids, tannins and essential oils (including those with turmerones and sesquiterpenes), as well as terpenoids, saponins and the health-related peptide turmerin. [1, 2, 3]

TURMERIC – HEALTH IMPACT MEDIATED BY THE MICROBIOME

Functional properties of turmeric-derived phytochemicals



- anti-inflammatory
- antiproliferative
- antimetastatic
- anti-angiogenic
- antidiabetic
- hepatoprotective
- anti-atherosclerotic
- antithrombotic
- anti-arthritic
- neuroprotective
- analgesic
- immunomodulatory
- pulmonoprotective

Properties with impressive health effects

Turmeric has long been an integral part of many health products due to its scientifically evaluated functional effects. These include antioxidant, antimicrobial, anti-inflammatory, hepatoprotective, immunomodulatory, neuroprotective, anti-cancer and hypoglycemic properties. In addition, turmeric can interfere with key cancer-associated signaling pathways by directly targeting proteins or regulating gene expression. [4, 5, 6, 7, 8]

All these effects play a decisive role in the long-term maintenance of human health. In addition, the positive influence of such biochemical processes also indicates the potential of a curative, therapy-accompanying application. [9, 10]

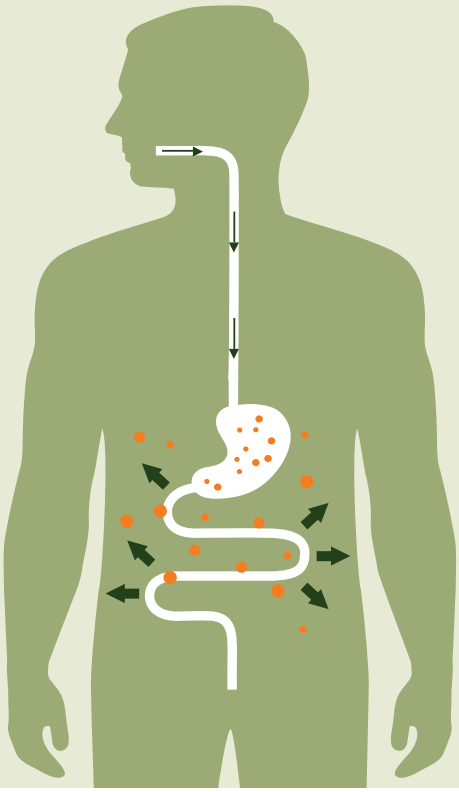
Curcumin in particular has been studied as a potential treatment for a range of diseases, including gastrointestinal, cardiovascular and neurological disorders, diabetes and several types of cancer. [15, 16, 17, 18, 19, 20, 21, 22]

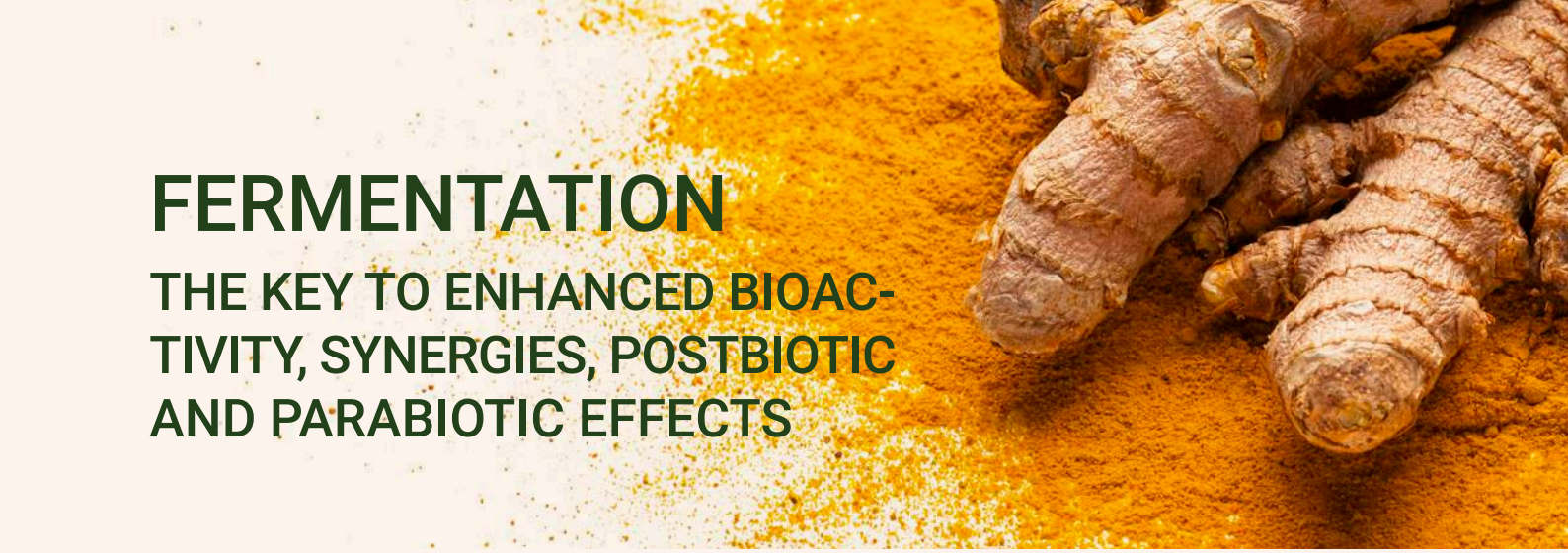
Health impact mediated by the gut microbiota

Curcumin and other turmeric components show low systemic bioavailability coupled with a wide pharmacological activity range. As a result, it is assumed that turmeric compounds have direct regulatory effects on gut microbiota.

Two different phenomena have been scientifically evaluated in the context of the interaction between curcumin and the gut microbiota. [11, 12] These are the direct regulation of gut microflora by curcumin and the biotransformation of curcumin by the gut microbiota, resulting in more active metabolites. [13]

Both functions seem to be essential for curcumin's activity and efficacy. There is also scientific agreement that dysbiosis (changes in the profile of the gut microbiome) may play a crucial role in the progression of many diseases in humans. [14]





FERMENTATION

THE KEY TO ENHANCED BIOACTIVITY, SYNERGIES, POSTBIOTIC AND PARABIOTIC EFFECTS

Fermentation is the ideal process for creating products that offer great health benefits for the human intestine. Combining turmeric with fermentation results in a unique product characterized by a perfect synergy of turmeric's own ingredients, extended by functional fermentation-specific metabolites. [23, 24] One such product has positive effects on intestinal health and thus on the entire body.

Fermented turmeric offers the health potential of:

turmeric + fermentative metabolites + their synergistic combination

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Fermentations are complex processes that are not easily managed, and process control is crucial for high product quality, functionality and safety. Moreover, this is also the basis for reproducible and standardized quality.

Within the large-scale production of fermentlife® Turmeric, the most important technological parameters (e.g. pH value, temperature and concentration of fermentation strains) are permanently monitored. In addition, selected fermentation metabolites (e.g. organic acids, sugar, curcuminoids) are analyzed in order to optimally control the progress of fermentation and its ideal termination.

The decisive factors for the selection of the three certified *Lactobacillus strains* – *L. plantarum, L. fermentum* and *L. brevis* – were their proven clinical benefits, their safety and the technological potential for turmeric fermentation. [41, 42, 43, 44] Once the fermentation process is complete, the matrix is far more complex and has greater potential for supporting intestinal health.

Process control

FERMENTLIFE® TURMERIC – KEY ADVANTAGES OF THE NEW FERMENTED.

Fermented products are characterized by clear and specific advantages.

Please note that the following summary represents only a small selection of the huge number of publications and studies on turmeric and turmeric fermentation.

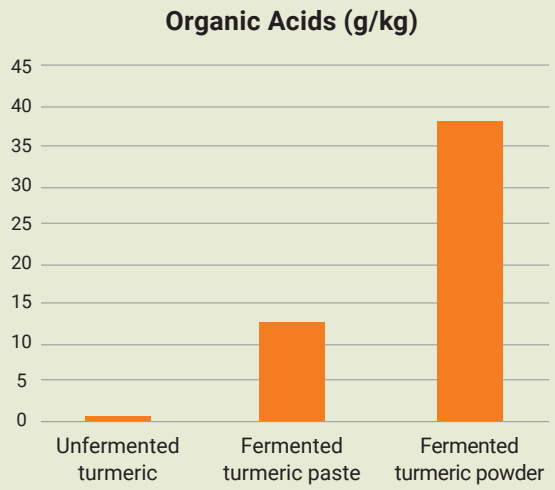
1. Widening the range of ingredients with pharmacological and post-biotic bioactivity

During fermentation, bacteria release a variety of health-promoting metabolites or postbiotics. These include organic acids, peptides, vitamins, biosurfactants and enzymes, as well as prebiotic polysaccharides and regulatory short-chain fatty acids (SCFAs). [20, 22, 25, 30]

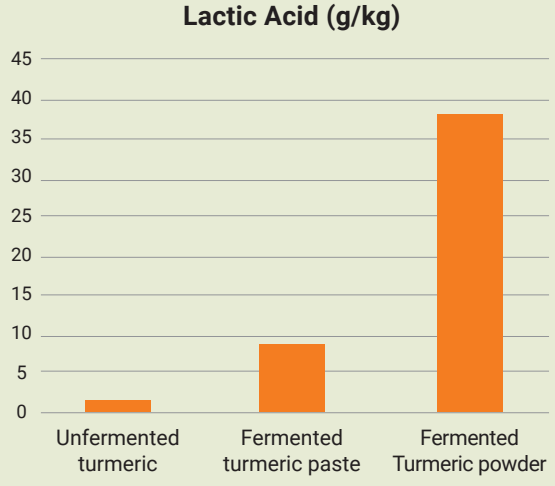
These fermentative changes have a positive influence on bioactivity because the bacteria structurally transform substances and inhibit anti-nutrients. In addition, mutually potentiating synergistic effects are also produced between the plant's own substances and fermentation metabolites. [26, 27, 32, 33]

Following fermentation, turmeric's ability to fight inflammation and act as an antioxidant increases and its anti-inflammatory effects work better. [24, 34] In addition, fermented turmeric effectively combats various pathogenic bacteria, [35] while its pharmacological (antioxidative, anti-inflammatory and immunomodulatory) activity is enhanced. [14, 23, 34, 35] Phenolic content is also increased by the fermentation process. [24]

In addition, tannins are degraded to gallic acid esters, which exert additional antioxidant activity, while glycosides are metabolized to easily absorbable and biologically more active aglycones.



Comparison of fermented and unfermented turmeric in terms of organic acid content.



Comparison of fermented and unfermented turmeric in terms of lactic acid content.

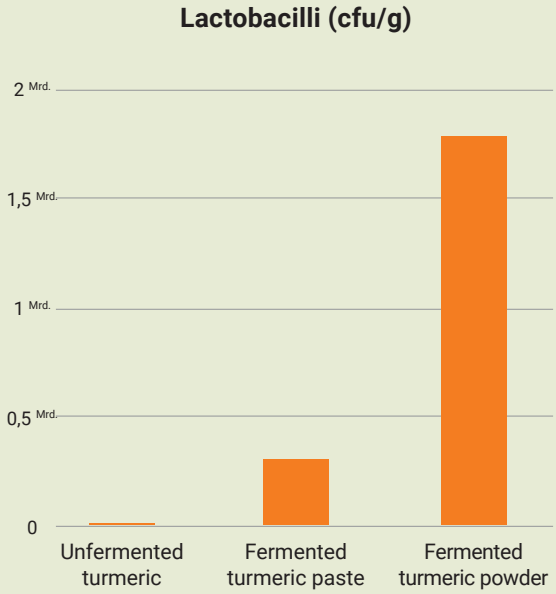
FERMENTLIFE® TURMERIC – KEY ADVANTAGES OF THE NEW FERMENTED.

2. Parabiotic – with advantages even compared to living bacteria

The microorganisms used for fermentation, e.g. *Lactobacillus* spp., maintain their health-promoting effects even in non-viable forms. This phenomenon is called the "postbiotic effect".

Key cell wall-related structures (e.g. lipoteichoic acid and exopolysaccharides) and secreted metabolites still have intestinal-relevant effects, mainly through immunomodulation, protection against pathogens and reinforcement of mucosal barrier integrity.[36, 37, 38, 39] A recent meta-analysis of 40 trials and 3913 subjects could not find a significant difference between the effects of viable and inactivated probiotic bacteria.

In contrast to live bacteria, inactivated bacteria are considered safe for high-risk patients (e.g. people treated with immunesuppressants).[40] When evaluating the concentrations of inactivated bacteria within pharmaceutical products, levels of approximately 10^9 cfu are common and effective. This corresponds to the concentration of inactivated bacteria in fermentlife® Turmeric.



Comparison of fermented and unfermented turmeric in terms of probiotic bacteria concentration.

FURTHER BENEFITS OF INACTIVATED BACTERIA

- No risk of intestine-to-blood bacterial translocation, even in immunocompromised individuals
- Loss of bacterial viability may promote additional beneficial functionalities
- Prevention of antibiotic-resistant gene transmission
- Enhanced direct interaction of released molecules and cell wall components of inactivated cells with epithelial cells
- Products are easier to standardize, transport and store

FERMENTLIFE® TURMERIC – KEY ADVANTAGES OF THE NEW FERMENTED

3. Increase in bioavailability

While there was no emphasis on increasing bioavailability as part of the development of post- and parabiotic fermentlife® Turmeric, an increase in bioavailability was observed. During fermentation, bacteria break down the turmeric cell walls with their complex enzymes, releasing bound micronutrients and degrading absorption-inhibiting anti-nutrients. Fermentation acts as a kind of predigestion, making it easier for the body to use the valuable parts of plants.[25, 26, 27]

Fermentation with Lactobacilli changes curcuminoids into more effective and soluble metabolites, such as tetrahydrocurcuminoids (THC), in a similar way to what happens in the human intestine.[28, 29] This enzymatic conversion has been evaluated many times specifically for *L. plantarum* and is linked not only to an increase in antioxidant potential but also to improved bioavailability. Even for the fermented full matrix of turmeric, results show that fermented turmeric has better bioavailability, which is linked to higher levels of polyphenolic compounds in rat plasma.

4. Positive influence on smell & taste

Fermentation can harmonize sensory characteristics by reducing undesirable components. Fermentation metabolites give products a completely new flavor and expand their sensory character with previously unachievable results. In the case of turmeric, fermentation reduces the bitter and earthy taste which normally limits how much can be tolerably consumed. This may lead to consumption of turmeric on a more regular basis, resulting in an even greater positive impact on health.

The above summary clearly shows that fermented botanicals are beyond comparison to the unfermented raw material. The changes fermentation causes are of a complex, functional and fundamental nature, creating a turmeric product that undoubtably has far greater benefits and value for human health.

fermentlife®
TURMERIC

A UNIQUE FERMENTATION PRODUCT WITH HIGH AND SPECIFIC BIOACTIVITY

Fermentlife® Turmeric powder

A product with the synergistic and bioactive potential of turmeric's own ingredients, complemented by numerous fermentative metabolites:

- Contains a wide spectrum of health-relevant curcuminoids
- Contains a variety of valuable fermentation metabolites
- Synergistic effects of turmeric's own ingredients with fermentation products
- Fermented with three naturally occurring, certified lactobacilli found in the intestine
- Important postbiotic effect of the inactivated bacterial components

Certified fermentation strains

- *Lactobacillus plantarum, L. brevis, L. fermentum*
- All known for proven clinical benefit and safety

Bioactive & synergistic spectrum of ingredients

- Flavonoids and tannins
- Terpenoids
- Essential oils
- Curcuminoids
- Saponins
- Turmerin
- Organic acids
- Short-chain-fatty acids (SCFA's)
- Exopolysaccharides
- Glucanes
- Inactivated probiotic *Lactobacilli*

Specified quality

> 2,5 %	curcuminoids (curcumin, demethoxycurcumin, bisdemethoxycurcumin, tetrahydrocurcumin)
> 3,0%	organic acids
> 2 x 10^9 cfu/g	*L. plantarum, L. brevis, L. fermentum* (concentration at the point of inactivation)

A UNIQUE FERMENTATION PRODUCT WITH HIGH AND SPECIFIC BIOACTIVITY

Dosage Example

based on intake 1g per day

equivalent to minimum **25 mg** curcuminoids

equivalent to minimum **30 mg** organic acids

equivalent to minimum **2 billion** inactivated lactobacilli

Functional properties

focus on gut health and positive impact on microbiome

parabiotic and post-biotic effects

enhanced antioxidant, anti-inflammatory, antimicrobial, immunomodulatory properties

Note

fermentlife® Turmeric Powder was not developed to maximize curcuminoids, but rather to create a fermented matrix with high synergistic and postbiotic potential for intestinal health.

Application

- Nutritional and dietary supplements, available in capsules or tablet form and for ready-to-use powder blends
- Ideal for giving a health upgrade to a wide range of foods, including spices, snacks, baked goods, ready meals and breakfast cereals

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