



The Importance of Water-Soluble Components of Turmeric for Holistic Joint Health

HOW TURMACIN® HARNESSSES THE POWER OF TURMEROSACCHARIDES™ TO REDUCE PAIN AND INFLAMMATION

Turmacin™



Demographics of Joint Health

In many parts of the world, especially in Japan and numerous European countries, longer life spans have increased the average age of the population. This trend will continue to spread to more countries; by 2050, two billion people will be over the age of 60, comprising 22% of the world population.¹ In some countries, such as China, the percentage of elders could be almost double the worldwide average. In the United States, census data estimates that 83.7 million people will be 65 years or older by 2050, almost twice the figure from 2012. This is largely because the baby boom generation started turning 65 in 2011. The youngest boomers will be seniors by 2029.²

As this group grows, so will the number of people with conditions associated with aging. In the United States, there are currently 54 million adults living with doctor-diagnosed arthritis.³ That number is expected to soar to 78 million by 2040.⁴ Worldwide, it's estimated that 130 million people will suffer from joint problems such as arthritis by 2050.

Who Is Most Affected by Joint Pain?



Women

Almost 60% of American adults with arthritis are women⁵

Severe joint pain is higher among women (29.2%) than men (22.7%)⁶



People with chronic conditions

49% of adults with heart disease have arthritis¹³ and 47% of adults with diabetes have arthritis¹⁴

Painful joints can be caused by arthritis, bursitis, gout, strains, sprains, and other injuries



Working age adults

Almost 2/3 of adults with arthritis are 18-64 years of age⁷

Severe joint pain is highest among adults aged 45-64 (30.7%) compared to seniors (24.3%)⁸



Overweight and obese

Obese adults have about 2x the rate of arthritis (31%) compared to under/normal weight adults (16%)¹¹

Overweight people have 4-5x the risk of knee osteoarthritis¹²



Gym Goers

Middle-aged adults who engage in high-impact physical activity are at increased risk for knee damage⁹

56% of active adults have sustained an exercise-related injury¹⁰



Everyone

About 1/3 of adults report having joint pain within the last 30 days

The most common form of joint pain is knee pain, followed by shoulder and hip pain¹⁵

The Joint Health Market

In the next five years, the global market for bone and joint health ingredients is forecast to grow at a rate of 6.3% (CAGR), mainly due to the graying populations of the developed world. It is projected to reach 3.5 billion U.S. dollars by 2024.¹⁶ While older people are the primary drivers of the joint health market, athletes and weekend warriors are feeling the short-term effects of vigorous exercise on their joints and are also looking for proactive solutions to help prevent deterioration later in life.



Popular Solutions for Joint Health...and Their Limitations

There are various remedies for joint pain and stiffness, but they all have their limitations. Pharmaceuticals, such as nonsteroidal anti-inflammatory drugs (NSAIDS), often have alarming side effects when used long-term. Collagen requires doses high enough to be cumbersome, the scientific evidence for glucosamine is mixed, and there are sustainability problems with the harvesting of boswellia.

Turmeric is the leading botanical ingredient for joint health. The most popular and researched component of turmeric is curcumin. Although curcumin is well studied for its bioactivity, consumers face major challenges due to its extremely low bioavailability. Curcumin is not soluble in the aqueous environment of the gastrointestinal tract, due to its polarity and poor dissolution rate. As a result, it is poorly absorbed in the system.

In addition to the bioavailability issue, curcumin is typically extracted with harsh industrial solvents — a concern for many consumers in the age of clean-label products.

Consumers are looking for safe, natural, effective and convenient solutions for joint health. Is the answer a different kind of turmeric extract?



Turmeric: The Golden Spice

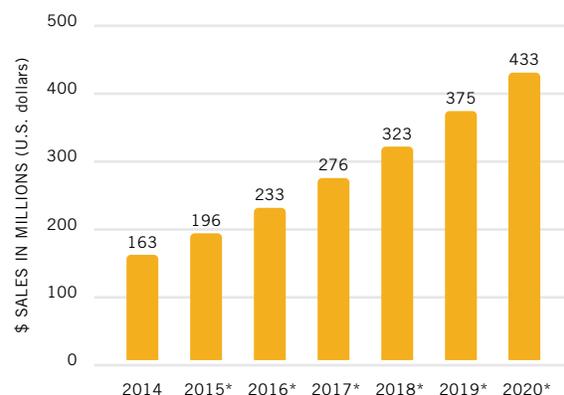
Traditional Uses of Turmeric

Turmeric has an almost 4,000-year long history of use in India as a culinary spice, cosmetic ingredient, and medicinal herb. Ground, dried turmeric root gives curries their golden color and distinctive taste. The root can also be eaten fresh and is popular in stews and soups. In the cosmetic realm, turmeric is applied topically to give the skin a golden glow.¹⁷ And in Ayurvedic medicine, it is used for multiple purposes, including digestive disorders — such as dyspepsia, acidity, indigestion, flatulence, and ulcers — as well as to ease pain and inflammation.¹⁸

Turmeric Trends

Turmeric is hot! In 2017, turmeric was the 10th-best-selling mainstream herbal supplement ingredient in the United States. Just one year later, it had climbed to the number five spot.¹⁹ In terms of dollar sales, 2017 saw turmeric sales grow 46.7% in the mainstream retail channel over the previous year.²⁰ During that same year, turmeric retained its number-one-selling herbal ingredient status in the natural channel, growing 12.2%.²¹ According to a report by Nutrition Business Journal, U.S. turmeric sales topped \$320 million in 2018.²² The U.S. turmeric market is projected to reach \$433 million by 2020.²³

Turmeric Projected Sales Growth

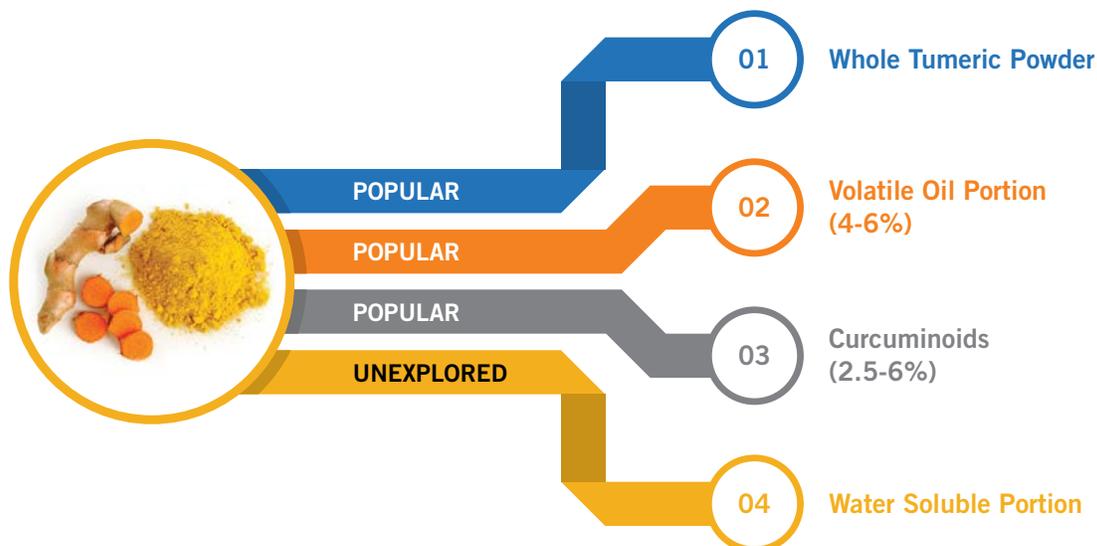


Water-Soluble and Oil-Soluble Components of Turmeric

Classic Ayurvedic preparations of turmeric are sometimes oil-based (for example Sneha, which combines turmeric with ghee) and sometimes aqueous (for example Kashaya, which blends turmeric with water). This shows that both oil and water-soluble portions of turmeric have a history of traditional use.

Yet to date, the vast majority of research on turmeric-based products has been conducted on 1) whole turmeric powder 2) volatile oil portions of turmeric or 3) isolated curcuminoid extracts (especially curcumin). Meanwhile, over 90% of the remaining water-soluble constituents of turmeric have been neglected and rarely investigated for their own health benefits. That begs the question: what have we been throwing away?

At Natural Remedies, we were on a quest to discover these unexplored components of turmeric. After years and years of research by our team of herbalists and scientists, we discovered that turmeric also contains a special class of water-soluble polysaccharides that are potent, promising, and bioactive. We named them Turmerosaccharides™.



Discover the Power of Turmerosaccharides[™]

Research indicates that like curcumin and turmerones (another fat-soluble class of turmeric constituents), Turmerosaccharides[™] support joint health and function by easing pain and reducing inflammation. In fact, one *in vivo* study found an oil-free aqueous extract of turmeric was comparable to curcuminoids and turmerones in combating acute and chronic inflammation.²⁴ In addition, four well-controlled human clinical trials have found that Turmerosaccharides[™] reduce joint tenderness and support physical function of the joints.

Unlike curcuminoids, Turmerosaccharides[™] do not require additional processing to be bioavailable. They are already in a form that is easily absorbed, retained, and utilized.



Introducing Turmacin[®] for Pain, Inflammation and Joint Health

Based on positive results from our pre-clinical studies, Natural Remedies developed a unique turmeric extract called Turmacin[®], which we then subjected to clinical testing. An innovative ingredient in the crowded turmeric field, Turmacin[®] is the first standardized turmeric product to focus on the much-ignored water-soluble components of turmeric — TurmerosaccharidesTM.

Benefits of Turmacin[®]:

	<p>Is a water-extracted turmeric product, completely untouched by solvents.</p>
	<p>Does not contain any curcuminoids and is naturally bioavailable because of its water solubility.</p>
	<p>Has powerful anti-inflammatory activity and reduces pain severity by 50% in 3 hours, according to pre-clinical research.</p>
	<p>Reduces joint tenderness and supports physical function of the joints, as demonstrated by four randomized, placebo-controlled human clinical trials.</p>
	<p>Is safe for long-term use, as shown in both pre-clinical animal as well as human safety studies.</p>
	<p>Can be incorporated into a wide variety of formulations, both solid and liquid.</p>

Turmacin® is Supported by 5 Clinical & 7 Pre-Clinical Studies

Clinical Evidence for Turmacin®: Study 1

Title: Safety and efficacy of *Curcumin longa* extract in the treatment of painful knee osteoarthritis: a randomized placebo-controlled trial²⁵

Study Design: Researchers divided study participants into four groups. One group took 500 mg of Turmacin® twice a day, a second group took glucosamine (1.5 grams a day), a third group took both, and a fourth group took placebo for 42 days.

On days 21 and 42, participants were evaluated using three scales: the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), the Visual Analog Scale (VAS), and the Clinician Global Impression Change (CGIC). The first two scales are based on patients' self-reported symptoms. The third is based on an exam conducted by an orthopedic specialist who checks the patient for joint tenderness, crepitation (a crackling sound in the joint), limitation of movement, partial dislocation of the joint, and muscle wasting near the joint.

Dosage: 500 mg twice per day

Results:

- Turmacin® achieved statistically significant effects in all three scales.
 1. WOMAC: scores decreased by 51% versus 16% for placebo
 2. VAS: scores plunged by 71% versus 25% for placebo
 3. CGIC: scores dropped by 57% versus 18% for placebo, with Turmacin® reducing joint tenderness, crepitation, swelling and immobility

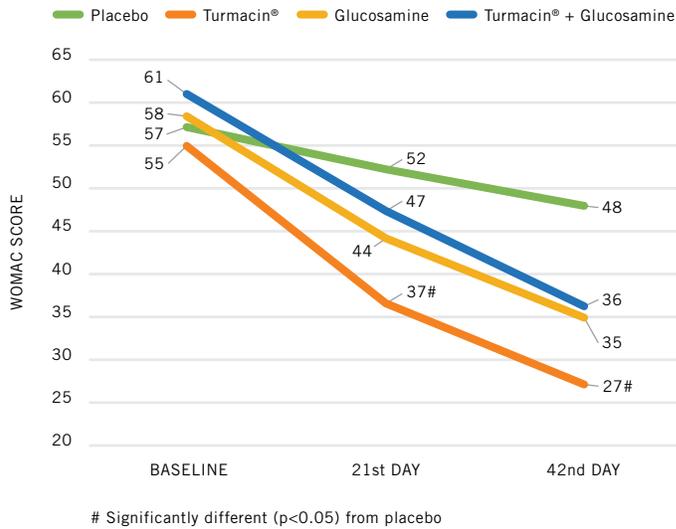


- 57% of volunteers taking Turmacin® did not resort to rescue pain medication during the study versus 17% in the placebo group
- Turmacin® outperformed glucosamine, which only trended toward statistical significance, on all three scales

Key Takeaway: *This study shows that Turmacin® is effective for symptom relief among people with osteoarthritis.*

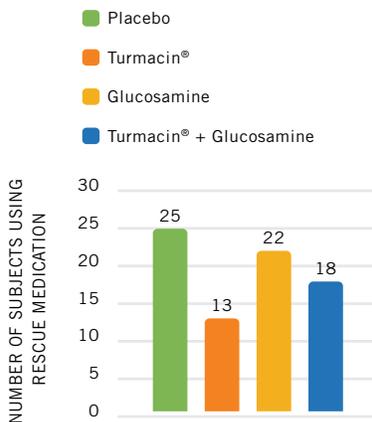
Clinical Evidence for Turmacin[®]: Study 1

Turmacin[®] Efficacy Evidence: WOMAC Score



Turmacin[®] decreased WOMAC score by 51% compared to placebo (16%)

Turmacin[®] Efficacy Evidence: Usage of Rescue Medication



57% of participants did not use rescue medication to relieve pain over the course of the study

Clinical Evidence for Turmacin®: Study 2

Title: Effect of Turmacin® supplementation on joint discomfort and functional outcome among healthy participants – a randomized placebo-controlled trial

Participants: 90 healthy volunteers

Study type: Double-blind, placebo-controlled, randomized clinical trial

Study Design: Study volunteers were divided into three groups. The first group took 500 mg of Turmacin® daily, the second group took 1,000 mg daily, and the third group took placebo for 12 weeks.

The participants were evaluated on days 1, 5, 7, 28, 56, and 84, at which time they participated in various forms of physical exertion. Researchers evaluated participants' pain levels using the VAS scale, measured range of motion and time to onset of pain after exercise, and evaluated joint and muscle function.

Dosage: 500 mg or 1,000 mg per day

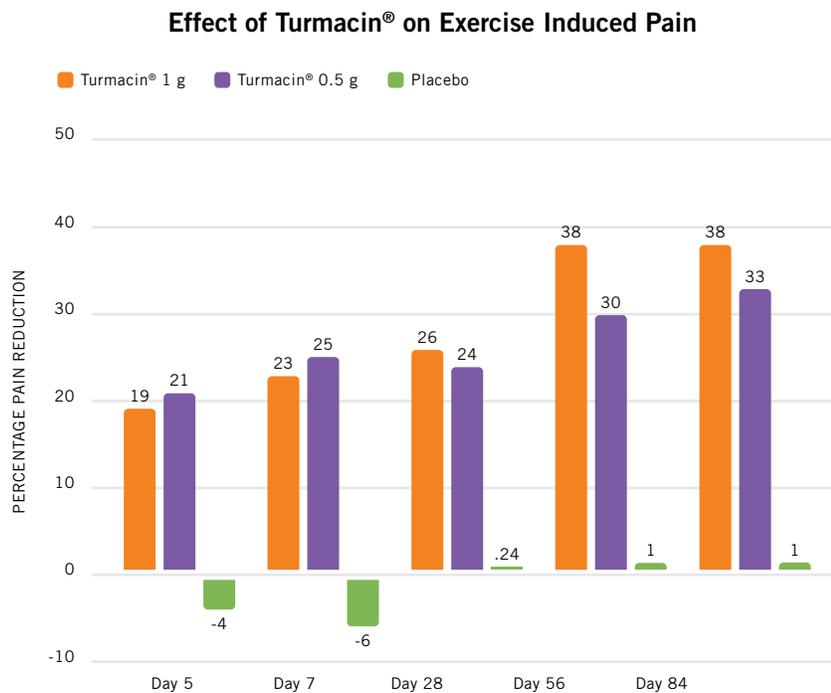


Clinical Evidence for Turmacin®: Study 2

Results:

- Turmacin® significantly decreased joint pain by day 5.
- Turmacin® increased time to onset of pain during exercise.
- Turmacin® preserved muscle strength during periods of physical inactivity.
- Turmacin® improved joint mobility.

Key Takeaway: Previous research has shown that Turmacin® is effective for symptom relief among people with osteoarthritis. This study indicates that Turmacin® also has joint and muscle health benefits for healthy and physically active people.



Turmacin® significantly decreased joint pain by day 5.

Clinical Evidence for Turmacin®: Study 3

Title: A randomised placebo-controlled clinical trial of *Curcuma longa* extract for treating symptoms and effusion-synovitis of knee osteoarthritis

Participants: 70 participants with significant knee pain, knee osteoarthritis, and the presence of a moderate amount of effusion-synovitis (inflammation of the synovium)

Study type: Double-blind, placebo-controlled, randomized clinical trial

Study Design: Study volunteers were randomly assigned to take either a combination of Turmacin® and curcuminoids (800 mg Turmacin® plus 200 mg curcuminoids) daily or placebo for 12 weeks.

At the beginning of the study and again after 12 weeks, the participants underwent knee MRI scans and their knee pain was calculated using the VAS scale.

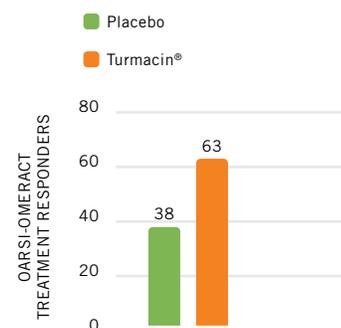
Dosage: 800 mg Turmacin® plus 200 mg curcuminoids per day

Results:

- The Turmacin®/curcuminoids combination significantly decreased knee pain (as measured by VAS and WOMAC)
- The Turmacin®/curcuminoids combination significantly increased knee function (as measured by WOMAC)
- Significantly more participants responded to the Turmacin®/curcuminoids combination versus placebo (as measured by OARS-OMERACT)
- There was no difference between the Turmacin®/curcuminoids combination and placebo in MRI-assessed effusion-synovitis volume. However, the researchers noted that this was a short-term study. Effects on knee structure may take longer to achieve.

Key Takeaway: *Compared to placebo, the Turmacin®/curcuminoids combination significantly improves knee pain and function among people with inflammatory knee osteoarthritis.*

Treatment Response to Turmacin®/Curcuminoids



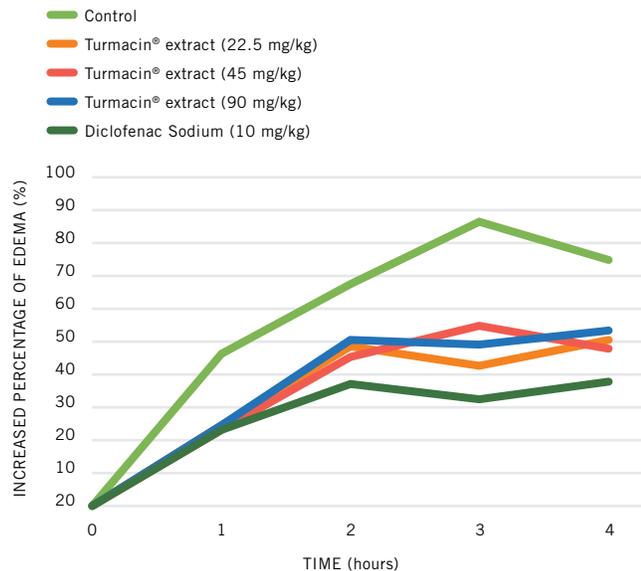
63% of participants taking the Turmacin®/curcuminoids combination responded to treatment versus 38% for placebo

The Effect of Turmacin[®] on Inflammation and Pain Severity

Preclinical animal studies show Turmacin[®] significantly reduces joint pain.^{26, 27} In one of these studies, pain (as measured by how much weight the animals bore on their injured hind legs) was reduced by 50% in 3 hours. The effect lasted for 24 hours.²⁸ As in humans, Turmacin[®] was more effective at decreasing joint pain than glucosamine. Turmacin[®] also reduced inflammation compared to untreated controls.^{29, 30} *In vitro* research provides additional evidence for the ability of Turmacin[®] to suppress inflammation.³¹

Key Takeaways: *Turmacin[®] not only reduces joint pain — it works quickly (within three hours) and is long-lasting (continuing for 24 hours). This is likely due to its ability to squelch inflammation.*

Effect of Turmacin[®] on Inflammation (Edema)



Turmacin[®] reduced edema in an animal model.



Turmacin[®] Modes of Action

Turmacin[®] has multiple modes of action.

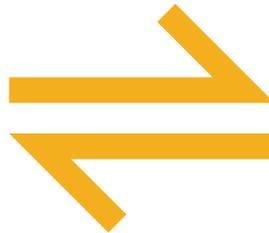
- Reduces markers of collagen degradation (IL-6, IL-8, COX-2, PGE₂, TNF-alpha, ICAM-1) in human articular cartilage cells.
- Reduces cartilage damage by increasing gene expression of type II collagen, decreasing gene expression of MMP-3 and MMP-7, and by protecting glycosaminoglycans.
- Inhibits NF-kappa-beta, a protein complex implicated in chronic inflammation.
- Slows hydrogen peroxide-induced aging of cartilage cells.

These combined actions slow the degradation of existing cartilage while supporting the synthesis of new cartilage, helping to keep these natural processes in a healthy balance.^{32, 33}

Turmacin Mechanism of Action

Reduces production of:

- Pro-inflammatory mediators
- Inflammatory mediators
- Reactive oxygen species
- Aging



Increases synthesis of:

- Collagen synthesis
- Proteoglycan synthesis
- Anti-inflammatory cytokines

Turmacin[®] Health Benefits

Adults with symptoms of osteoarthritis

- Decreases self-reported pain and stiffness
- Decreases practitioner-assessed joint tenderness, swelling, crepitation, and limitation of movement
- Reduces the use of NSAIDs and other OTC pain medications

Healthy, physically active adults

- Decreases exercise-induced joint pain
- Increases joint mobility
- Increases time to onset of pain during exercise
- Preserves muscle strength during periods of inactivity and supports joint range of motion
- Improves muscle tension

Turmacin[®] Dosage

Symptom relief among adults with osteoarthritis: 500 mg, twice per day

Joint and muscle health among active adults: 500 mg daily for physically active people and 1,000 mg daily for sedentary people

Turmacin[®] Clinical Safety Study

A placebo-controlled, 12-week human study with 83 healthy participants tested the safety of Turmacin[®] at 500 mg and 1,000 mg compared to placebo. The results found no significant differences between the three groups in any of the parameters measured, including AST, ALT, blood sugar, creatine, and hemoglobin. Extensive *in vitro* and animal studies have also confirmed the safety of Turmacin[®]. In animal studies, Turmacin[®] at a dose of up to 5 grams per kilogram of body weight — many times the human dose — was found to be safe.*^{34, 35}

GRAS Status

Turmacin[®] has achieved self-affirmed GRAS (Generally Recognized as Safe) status, enabling its incorporation into food and beverages.

Turmacin[®] Applications

Sports

Both serious athletes and weekend warriors may suffer from sore muscles and joints post-exercise. Turmacin[®] is an excellent choice for endurance products because it increases the time to onset of pain during exercise, allowing fitness enthusiasts to push harder, longer. And since it effectively eases joint pain and increases joint mobility in physically active people, Turmacin[®] can also be included in recovery formulas. This allows trained athletes to keep up their training regimens and gym-goers to stick with their exercise routines.



Healthy Aging

Fifty percent of people aged 65 and older have doctor-diagnosed arthritis.³⁶ Not only can arthritis impact mobility and the ability to carry out everyday tasks, it can also decrease overall quality of life. Turmacin[®] has been clinically demonstrated effective for relieving symptoms of arthritis — including joint pain, swelling, immobility, and dysfunction — making it an excellent choice for joint health products. One of its modes of action is to inhibit the inflammatory compound NF- κ B, so Turmacin[®] can also be incorporated into more global anti-aging products aimed at quelling systemic inflammation.

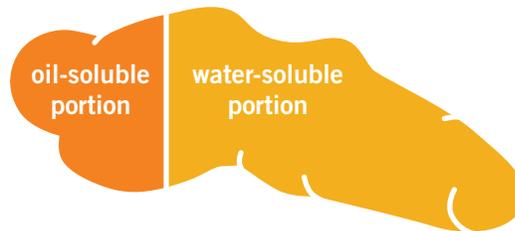
Functional Foods and Beverages

Turmacin[®] has achieved self-affirmed GRAS status, so it is approved for use in functional foods and beverages. Unlike fat-soluble curcuminoid preparations, Turmacin[®] dissolves easily in water and stays in solution. Because it does not precipitate out, it prevents cake formation. Additionally, because it does not contain the highly pigmented curcuminoids, Turmacin[®] is non-staining of manufacturing equipment, making it easy to work with.

Combining Turmacin[®] with Curcuminoids for Full-Spectrum Activity

Turmacin[®] can be used as a standalone ingredient or combined with curcuminoids to create a full-spectrum turmeric product delivering both fat and water-soluble components of the herb. This approach may be particularly appealing to consumers who are drawn to the concept of whole-herb standardized extracts.

Curcumin + Turmacin[®] = Full-Spectrum Activity



Turmacin[®] may also be combined with a variety of other dietary ingredients to create synergistic formulations. The most obvious application for Turmacin[®] is joint health products. However, since it has documented anti-inflammatory activity, and inflammation is recognized to underlie many chronic conditions, Turmacin[®] is appropriate for all types of formulations, from cardiovascular health to blood sugar control products.

Formulation Benefits

Because of its water-soluble nature, Turmacin[®] can be incorporated into:

- Capsules, tablets, soft gels
- Sprays, powders
- Beverages including RTD and shots
- Gummies, jellies, chews
- Functional foods



Turmacin[®] is:

- ✓ Standardized to Turmerosaccharides[™], the bioactive polysaccharides
- ✓ Water-soluble, so it's 100% naturally bioavailable
- ✓ Versatile, with a wide range of formulations possible
- ✓ Traceable, with a strong seed to shelf supply chain
- ✓ Non-staining of processing equipment, because it contains no curcuminoid pigments
- ✓ Clean label, made through aqueous extraction (no harsh industrial solvents)
- ✓ Combinable with Curcumin for full spectrum turmeric benefits
- ✓ Widely consumed, with 60 million doses sold globally

Certifications and Accreditations

Turmacin[®] is:

- Available Certified Organic by the USDA, EU, and India
- Non-GMO Project verified
- Kosher, Halal
- KFDA registered in Korea
- In the process of achieving ANVISA approval in Brazil



Scientific Publications

Research on the efficacy and safety of Turmacin[®] has been published in the following peer-reviewed scientific journals:

- *Anti-Inflammatory and Anti-Allergy Agents in Medicinal Chemistry*: 2015 & 2017
- *BioMed Research International*: 2013
- *Inflammopharmacology*: 2013 & 2018
- *Journal of the Korean Society of Food Science and Nutrition*: 2014
- *Pharmacognosy Magazine*: 2017
- *Pharmacognosy Research*: 2013



For reprints of any of the above articles, email us at: hhp@naturalremedy.com.

Conclusion

As the world population ages, demand for joint health and healthy aging products will only continue to grow. Out of many possible botanical ingredients, turmeric stands out as a promising solution. Turmacin[®] is a clinically tested, water-soluble turmeric extract rich in Turmerosaccharides[™] with anti-inflammatory and pain-reducing properties, proving there's more to turmeric than curcuminoids.

About Natural Remedies

Natural Remedies is a global research-driven botanical healthcare company whose core competency lies in manufacturing standardized herbal extracts. Its branded products are clinically substantiated, scientifically validated innovations. Known as a leader in scientifically based botanical extracts, Natural Remedies has contributed to various international pharmacopoeia, including over 100 monographs internationally and over 220 phyto-compounds isolated for global reference standards. Our vision is to harness nature and apply science for health and happiness.

Want to learn more?

✉ hhp@naturalremedy.com

🔗 www.naturalremedy.com

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