

WHITE PAPER  
January 2018



# TURMERIC

AYURVEDA'S SPICE OF LIFE



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## AYURVEDIC BOTANICAL **TURMERIC**

Recent research in natural products have high focus on innovations based on traditional wisdom/knowledge. The 2017 Nobel prize in physiology/medicine was awarded to Jeffrey C Hall, Michael Rosbash and Michael W Young for their “discoveries of molecular mechanisms controlling the circadian rhythm”. Interestingly, in ayurveda, before several thousands of years the scholars studied about “circadian rhythm” and recorded these observations in the “Dinacharya” and “Rithucharya”. The daily ritual of self care is called “Dinacharya” and incorporating changes with changes of season is called “Rithucharya”. In the same ayurveda- the branch of science introduced turmeric to the world- uses several formulations with “turmeric “ as key ingredient. Interestingly, these formulations were derived several thousands of years and still continue to use the same without any changes, and patients are getting very good relief. In all the formulations, turmeric decoctions were being used, knowing the potential of turmeric matrix in enhancing the bioefficacy.

In contrary, the researches in the modern era invented “Curcumin” as the key molecule responsible for the bioefficiency of turmeric and they isolated as these single molecule. In the nutraceutical industry, everyone started offering “Curcumin” with various technologies to improve bioefficacy and bioavailability, but these products couldn’t make a very good impact in the human clinicals even though they could generate few academic publications. The scientists in Aurea Biolabs analysed the gap between the traditional knowledge and modern biochemistry and realized the need of turmeric matrix for the bioefficacy of curcuminoids. Team Aurea-integrated biomaterial science, biochemistry and organic chemistry to derive a technology which improves the efficacy of natural bioactives with the help of Polar-Nonpolar “supporting molecules from nature”. They have branded this technology as “**PNS Technology**”. In the case of curcumin they could be able to include more than 200 molecules of turmeric as a single complex which is “Cureit”



Turmeric (*Curcuma longa*) is an Indian spice derived from the rhizomes of the plant and has a long history of use in Ayurvedic medicine as a treatment for inflammatory conditions. *C.longa* is a perennial member of the Zingiberaceae family and is cultivated in India and other parts of Southeast Asia.

The use of turmeric and its active constituents has been revered in the traditional Ayurveda medicine and traditional Asian Medicine for thousands of years for its medicinal/therapeutic properties.

The pharmacological properties of turmeric include

- Neuroprotective activity
- Hyaluronidase inhibitory activity
- Supports Cardiovascular health
- Supports immune health
- Cell protective effect
- Supports GI health
- Supports musculoskeletal health
- Hepatoprotective effect

Traditional Indian Ayurveda practitioners use turmeric as a stomach or liver tonic, blood purifier, arthritis management. It has also been used in many other traditional medicine systems including South East Asia, including Malaysia, Indonesia and Thailand to prepare herbal concoctions. The undocumented history of usage of turmeric in day to day activities in India dates back to more than 10000 years.



“ This whitepaper provides overview of bioavailability, superiority, scientific studies, and various health applications of Curcumin.

# NATURAL MATRIX OF TURMERIC

The phytochemical analysis of turmeric reveals that there are 200 plus molecules present in the natural matrix of turmeric with attributed health benefits. Main constituents include, the so called curcuminoids including Curcumin, Demethoxy Curcumin and Bis demethoxy curcumin. In addition to this the non curcuminoid components like Bisacurone, Cyclo curcumin, Ar-turmerone, Dihydro Ar-turmerone, turmeric proteins etc all play a major role in contributing the major health benefits of turmeric.

From ancient days onwards turmeric and its active constituents has been clinically proven for various kind of inflammatory disorders. Turmeric and its active components helps in maintaining healthy musculoskeletal joints, muscle strains and other inflammatory disorders. The antioxidant activity of curcuminoids is the main responsible factor for the anti-inflammatory activity of turmeric. But the major hurdle of curcuminoids is the poor bioavailability, thereby limiting its applications.

more than  
**200**  
active molecules

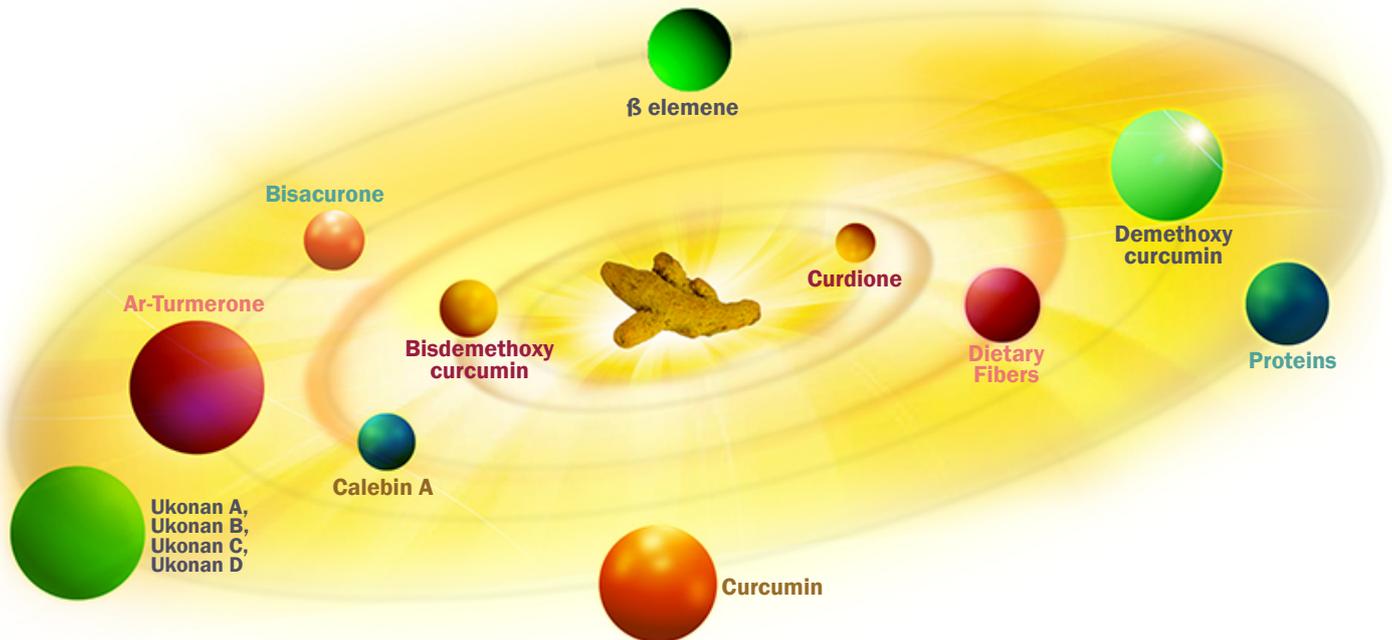
“

The antioxidant activity of curcuminoids is the main responsible factor for the anti-inflammatory activity of turmeric.



# RECREATING THE CURCUMINOIDS WITH PNS TECHNOLOGY

We at **Aurea Biolabs** have developed a unique formulation by *recreating the natural matrix of turmeric* branded as Cureit and sold in U.S as **ACUMIN**. The natural matrix of the turmeric plays a significant role in increasing the bioavailability of curcuminoids. The proteins, dietary fibers, carbohydrates and volatile oil Sesquiterpenes and bisabolones all contribute to the bioavailability of curcuminoids.



**β elemene**  
Cell protective effect

**Calebin A**  
Cell protective effect

**Curcumin**  
Supports immune health,  
Supports musculoskeletal health

**Bisacurone**  
Down regulates  
TNF-induced VCAM-1  
expression in HUVECs

**Ukonan A, Ukonan B,  
Ukonan C, Ukonan D**  
Phagocytosis activity,  
Supports immune health.

**Curdione**  
Inhibited the production of PGE2 in  
LPS-stimulated mouse macrophages  
through the suppression of COX-2

**Dietary Fibers**  
Supports immune health,  
Supports musculoskeletal health,  
enhance the bioavailability of  
biologically active molecules

**Proteins**  
Biologically active  
molecule carrier, Supports  
musculoskeletal health,  
Cell protective effect

**Bisdemethoxy curcumin**  
Supports Immune health,  
Supports musculoskeletal health,  
Supports cardiovascular health,  
hyaluronidase inhibitory activity,  
supports neuro health

**Ar-Turmerone**  
Supports musculoskeletal health,  
Cell protective effects

**Demethoxy curcumin**  
Supports immune health,  
Supports musculoskeletal health,  
Supports cardiovascular health,  
Supports neuro health

Polar–Non polar Sandwicing (**PNS**) technology the **patented technology** has gained lot of accolade from the time it has been launched

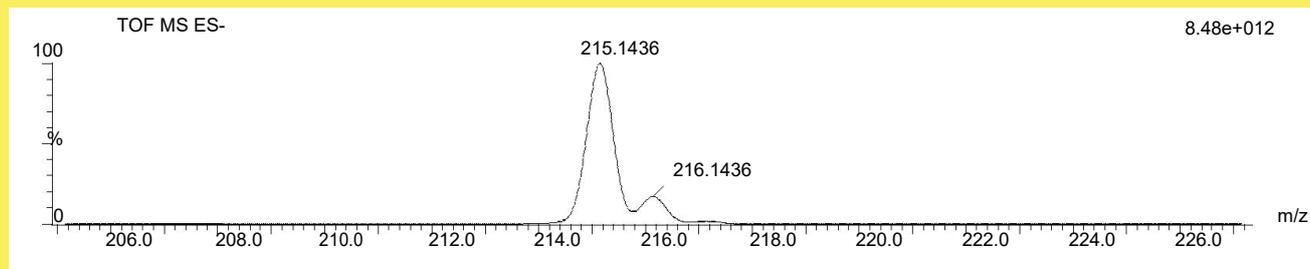


- PNS technology is used to increase the bioefficacy and bioavailability of the products by preserving the natural matrix of the product and without any degradation of the active molecules.
- PNS technology incorporates the polar and nonpolar compounds of the spice/herb of interest. The active molecules are well protected inside the polar- nonpolar matrix without any structural degradation.
- PNS technology ensures the delivery of the active molecules at the specific site thereby ensuring the bioefficacy of the product. The recreation of natural matrix also helps to increase the stability of the active molecules.
- PNS technology can be extended to any spice/herb to deliver products with ensured biological activity. The matrix provides advantages such as enhanced physical stability, protection of the curcuminoids from degradation in the body, controlled curcuminoid release, biocompatibility, and laboratory to industrial scalability.



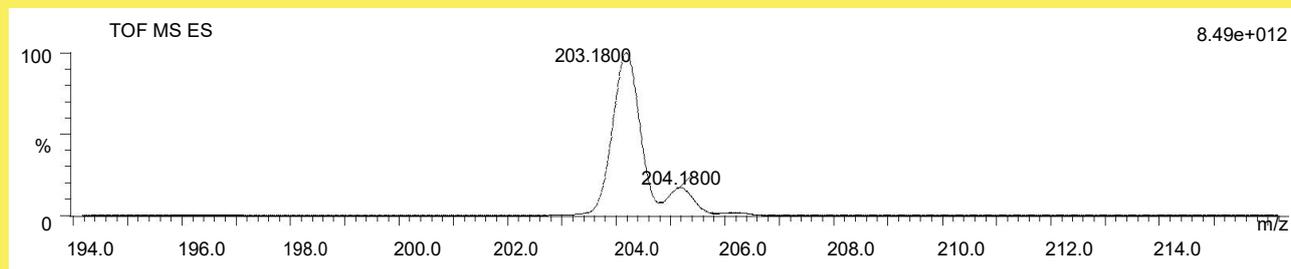
The presence of PNS technology have been characterized and confirmed by SEM, NMR, IR, XRD, DSC and TGA analysis. The active components of Cureit was evaluated using sophisticated instruments like QTOF, GC MS/MS etc

### Ar-Turmerone



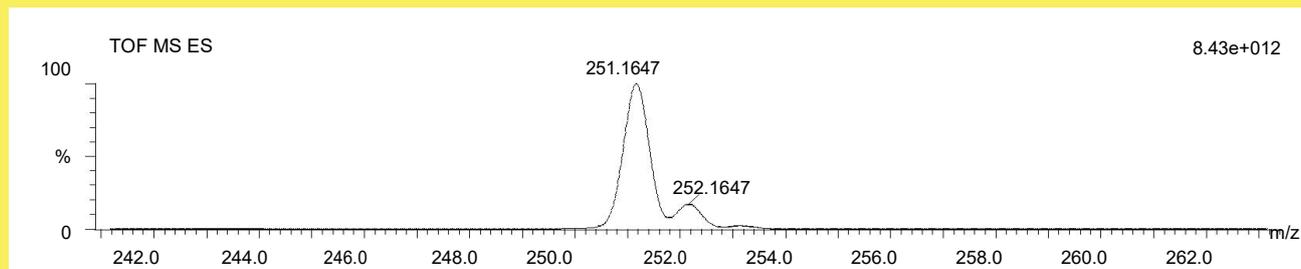
Mass	Calc. Mass	mDa	PPM	DBE	Formula
215.1436	215.1436	0.0	0.0	6.5	C15 H19 O

### β- Elemene



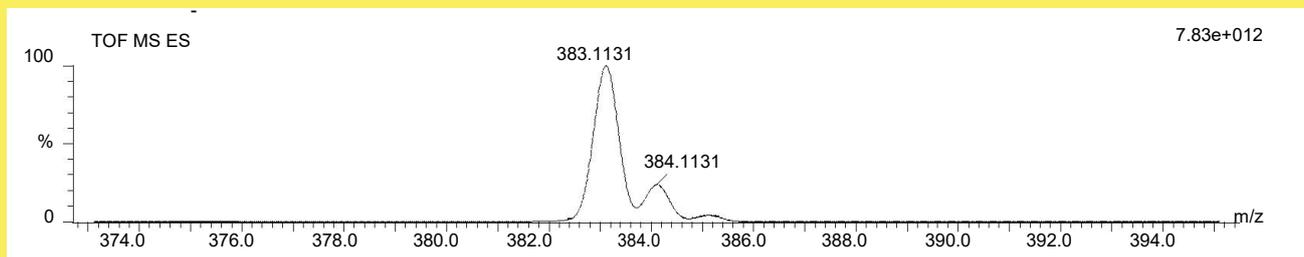
Mass	Calc. Mass	mDa	PPM	DBE	Formula
203.1800	203.1800	0.0	0.0	4.5	C15 H23

### Bisacurone



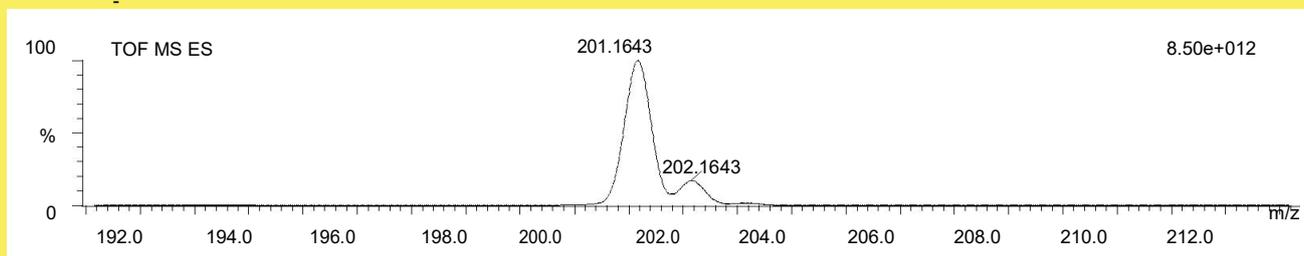
Mass	Calc. Mass	mDa	PPM	DBE	Formula
251.1647	251.1647	0.0	0.0	4.5	C15 H23 O3

### Calebin A



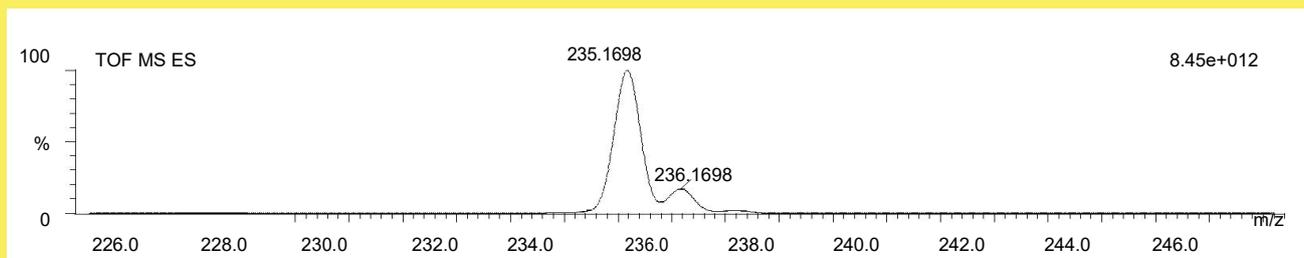
Mass	Calc. Mass	mDa	PPM	DBE	Formula
383.1131	383.1131	0.0	0.0	12.5	C21 H19 O7

### Curcumene



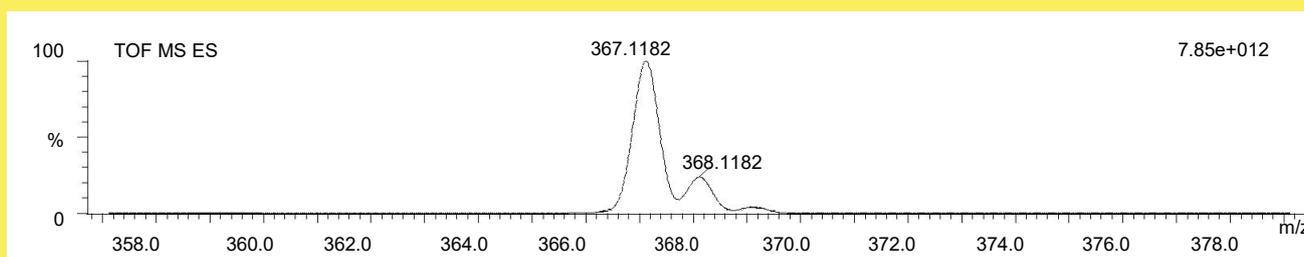
Mass	Calc. Mass	mDa	PPM	DBE	Formula
201.1643	201.1643	0.0	0.0	5.5	C15 H21

### Curdione



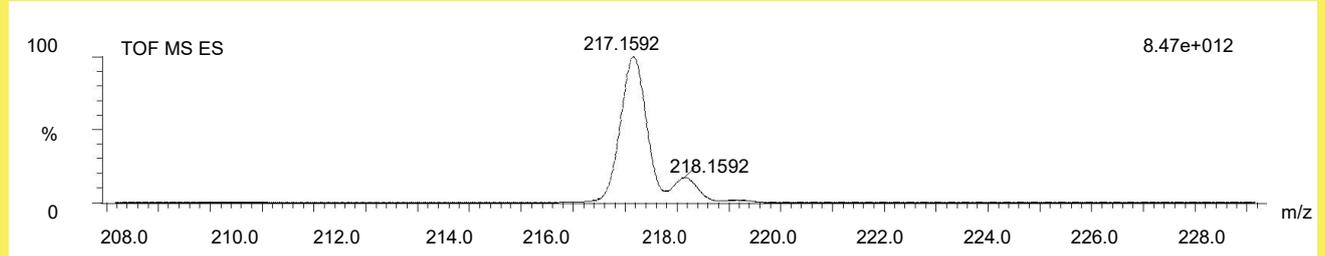
Mass	Calc. Mass	mDa	PPM	DBE	Formula
235.1698	235.1698	0.0	0.0	4.5	C15 H23 O2

### Cyclocurcumin



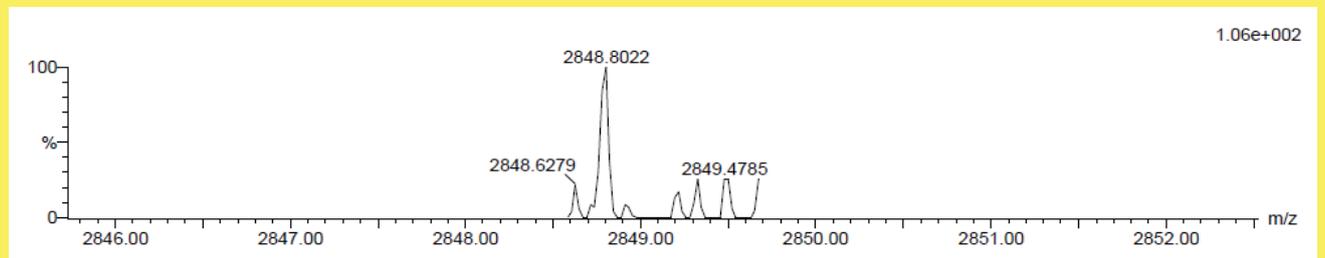
Mass	Calc. Mass	mDa	PPM	DBE	Formula
367.1182	367.1182	0.0	0.0	12.5	C21 H19 O6

**Dihydro Ar Turmerone**

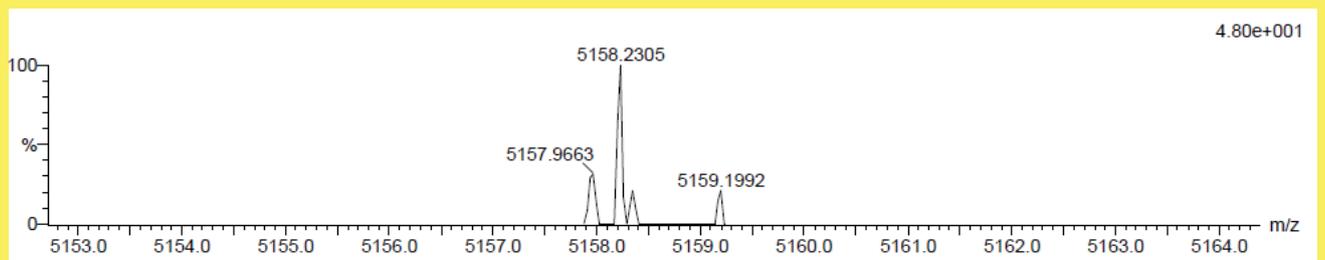


Mass	Calc. Mass	mDa	PPM	DBE	Formula
217.1592	217.1592	0.0	0.0	5.5	C15 H21 O

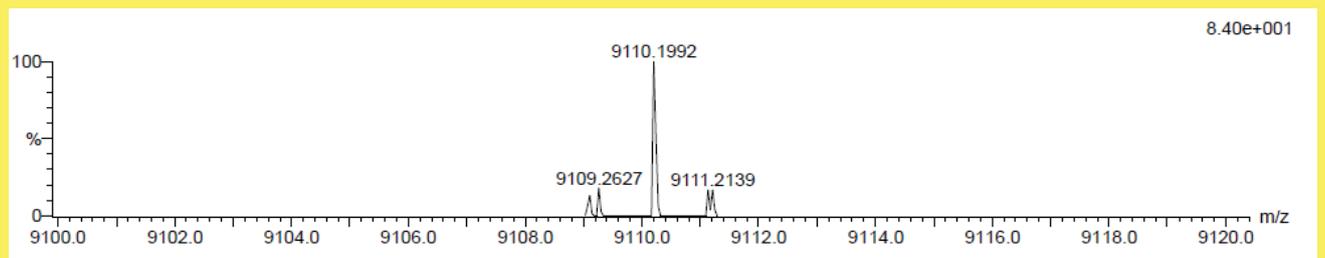
**2kDa protein**



**5kDa protein**



**9kDa protein**



# CLINICAL STUDIES & **BIOAVAILABILITY**

Curcuminoids is a pleiotropic molecule exhibiting various pharmacological actions, which involves the down regulation of inflammatory responses. Studies reveals that curcumin has the ability to down regulate the inflammatory responses like TNF- $\alpha$ , IL-1b, IL-6, IL-8, nuclear factor- $\kappa$ B (NF- $\kappa$ B), and cyclooxygenase-2 (COX-2). Cell culture and animal studies indicate that curcumin has potential as a support in rheumatological conditions.

Meta-analysis of eight randomized clinical trials concluded that doses of about 1000mg of curcumin per day were effective in controlling Rheumatological conditions, although the authors noted that additional studies were required to confirm the efficacy of curcumin.

Several cell line studies indicating the various pharmacological activities of Cureit was done by our group to prove the bioefficiency of the product. The studies included cell protective, antioxidant, elastase inhibitory activity, immune boosting etc.

Moreover the product has been clinically tested for bioequivalence in healthy human volunteers and proved to be 10 fold higher bioavailable than normal curcuminoids 95%. The product was also studied for cell protective, antioxidant, immune boosting, elastase inhibition activity. The Cmax(ng/mL) for curcumin from the completely natural matrix formulation and the unformulated product was 434.3 and 43.1 respectively and also the curcumin area under the curve (ng mL/h) for Cureit was 904.0 and for normal 95% curcuminoids it was 165.7 respectively. In conclusion the Cmax and AUC for Cureit in comparison with normal 95% curcuminoids were approximately 10 fold and 5.5 fold, indicating that the recreation of the natural matrix helps to increase the bioavailability and thereby increasing the bioefficacy\*.

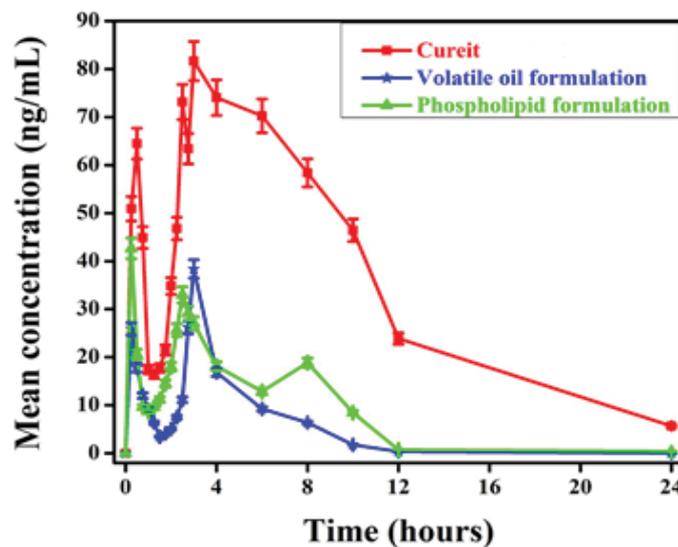
**10** fold  
higher  
**bioavailability**  
in terms of  
**free curcuminoids**



\* Recent article in Phytotherapy Research " Clearly shows the superiority of "Cureit" from all other brands.  
<http://onlinelibrary.wiley.com/doi/10.1002/ptr.5931/full>

## CLINICALLY COMPARING CUREIT vs OTHER LEADING CURCUMIN FORMULATIONS

A comparative study evaluating the bioavailability of Cureit with Curcumin phospholipid formulation and Curcumin volatile oil formulation was also carried out by our research group. 45 healthy male volunteers were enrolled during the study time and were divided randomly into equal three groups. 15 subjects were given an oral dosage of 500mg of Cureit, 15 were given 500mg curcumin with phospholipid formulation and 15 were supplemented with curcumin volatile oil formulation capsules. There were no reported adverse side effects during the study for any groups. Blood samples at specified time intervals were drawn out and serum plasma was separated and extracted to check the extent of absorption in each individuals. The samples were analysed by LCMS.



All the results were statistically evaluated

**Superior**  
over other  
Leading Brands

From the results it is evident that higher absorption of 366ng/ml was observed at the fourth hour. The absorption for curcumin phospholipid formulation and curcumin volatile oil formulation was found to be 138ng/mL and 104ng/mL respectively. The maximum plasma total curcuminoids (Cmax) and the AUC for Cureit were found to be 170 and 825ng/mL respectively, whereas the corresponding values for curcumin volatile oil formulation and curcumin phospholipid formulation 48 and 117ng/mL; 70 and 187ng/mL respectively.

The absorption of Cureit was approximately 7 fold greater than the volatile oil formulation in terms of absorption (AUC 0-t) and 3.6 folder in terms of rate of absorption and compared to the curcumin phospholipid formulation, the values were found to be 4.4 and 6.6 fold greater.

## CLINICAL STUDY ON

## CUREIT IN SUPPORTING RHEUMATOLOGICAL CONDITIONS

Recently our research group has done clinical study evaluating the efficacy of Cureit as a support in rheumatological conditions.

Thirty-six subjects were randomized in a 1:1:1 ratio to receive 250mg of the study product as the low dose Cureit, 500mg as the high-dose Cureit, and placebo (500mg of food grade starch) over a period of 3 months as one capsule twice daily 30min after meals. Dose setting of the study product was based on the bioavailability of the product compared to the 95% curcumin. Laboratory parameters as biomarkers of Rheumatological conditions included erythrocyte sedimentation rates (ESR), C-reactive protein (CRP), and rheumatoid factor (RF). Pregnancy tests were performed in women. A joint assessment was performed for a tender joint count (TJC), swollen joint count (SJC), and duration of morning stiffness. The study outcomes were evaluated using the American College of Rheumatology (ACR) response, Visual Analog Scale (VAS), C-reactive protein (CRP), Disease Activity Score 28 (DAS28), Erythrocyte Sedimentation Rate (ESR) and Rheumatoid Factor (RF) values. These observations were also confirmed by significant changes in ESR, CPR and RF values in patients receiving Cureit as compared to baseline and placebo.

### **Efficacy assessment of DAS28 and VAS values**

The treatment groups showed significant improvement in DAS28 and VAS scores at the end of the 90-day study based on the paired test and Mann-Whitney test ( $P \leq .001$ ). The percentage changes from baseline for the high-dose curcumin group resulted in decreases of 66% and 72% for DAS28 and VAS, respectively, while the low-dose group had decreases of 53% and 62%, respectively.



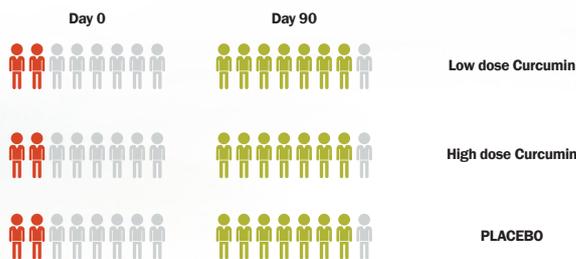
## Efficacy assessment of ESR values

Both high dose and low dose treatment showed significant decrease in the ESR values, there by indicating the efficiency of Cureit in supporting rheumatological conditions.

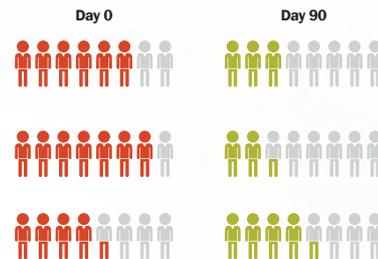
## ACR 20 Response

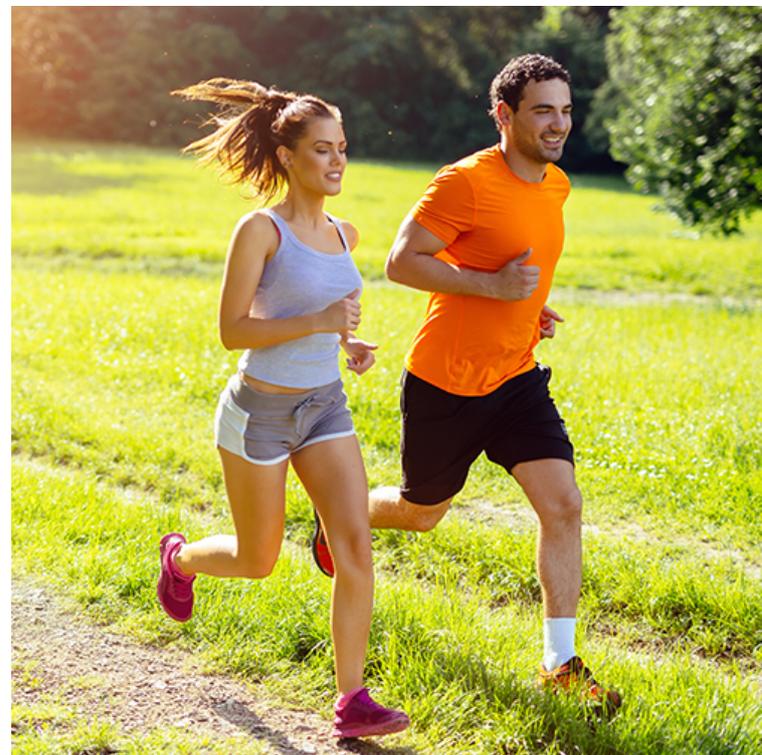
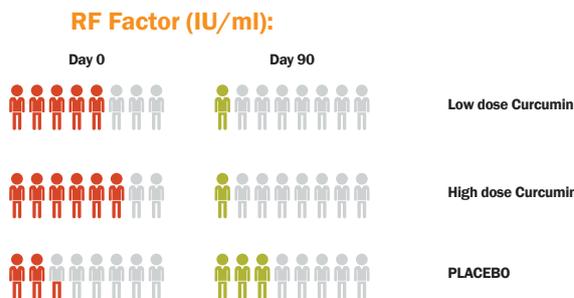
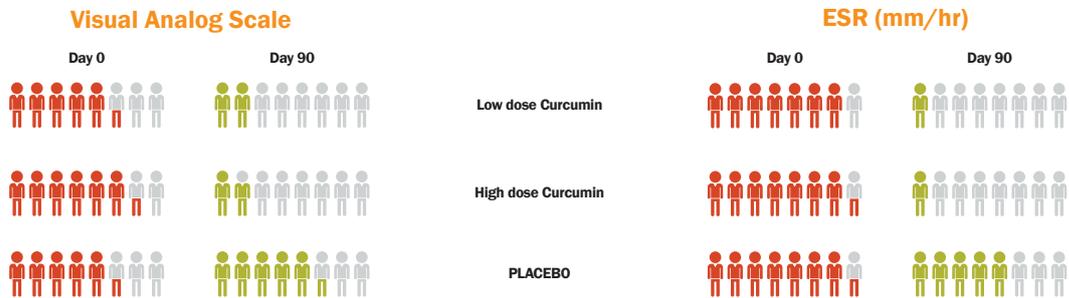
The severity of Rheumatological conditions is assessed on sections of the ACR scoring system. Each groups were analysed for the number of tender joints and number of swollen joints, the assessment of pain, patient's and physician's global assessments of disease activity, and patient's assessment of physical function. The mean ACR 20 values of both low dose and high dose treatment groups at the baseline were found to be 19 and 16 and at the end of treatment, the values were 65 and 68 respectively. Taking account of the swollen and tender joints, the treatment groups supplemented with 500mg Cureit showed decrease of 85% and 88% respectively; where as low dose showed 80% and 78% respectively.

### ACR Response



### Disease Activity Score





**Cureit**<sup>®</sup>

the highly bioefficacious curcuminoid formulation shows significant **anti-rheumatoid activity.**

Curcuminoids possess potential role in supporting musculoskeletal health. There are many scientific evidences supporting the same. The recreation of turmeric matrix has an important role in increasing the bioavailability and there by extending the bioefficacy of the product. The non curcuminoid content also possess potential anti-oxidant and anti-inflammatory activity.

The action of Curcuminoids against inflammation has proved via multiple molecular pathways, including reduced immune response, increased xenobiotic metabolism, resolution of inflammation through decreased neutrophil migration and increased barrier remodeling.

These data are evident from the ACR 20 responses of the subject groups.

# OTHER HEALTH BENEFITS

Several clinical studies have demonstrated Curcumin's health benefits in different applications. Curcumin supplementation has been shown to benefit in

## Brain

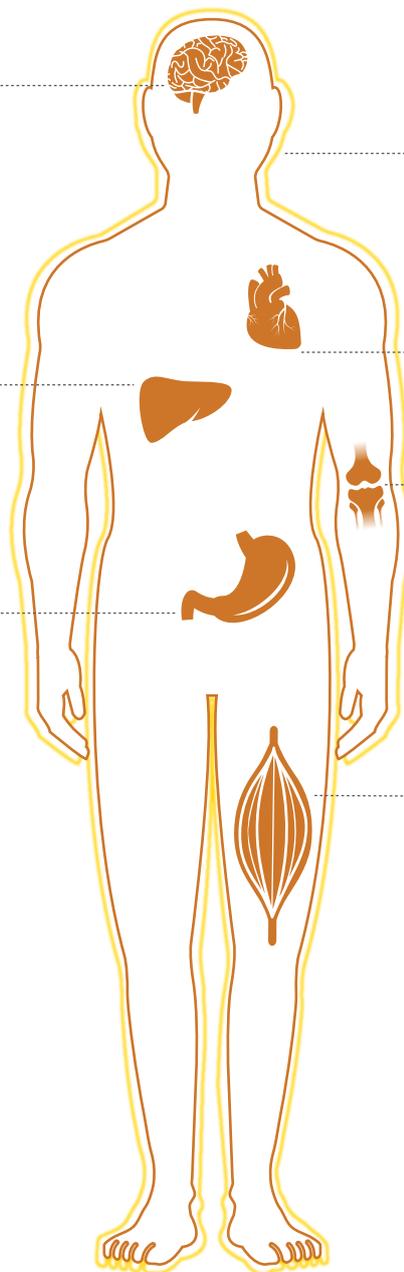
Supports Cognitive health  
Hyaluronidase inhibitory activity

## Liver

Supports in maintaining healthy blood glucose levels  
Supports in maintaining healthy liver by hepatoprotective effects

## Gut

Supports fight against inflammatory bowel diseases and maintaining a healthy gut



## General health

Supports Immune health

## Heart

Supports Cardiovascular health

## Joints

Supports Musculoskeletal health by reducing the cause of inflammatory conditions, reducing joint stiffness and soreness

## Muscles

Suits in sports nutrition by reducing the oxidative stress in muscles

## Conclusion

Cureit recreates the Natural matrix of turmeric, through innovative Polar-Nonpolar Sandwiching technology to ensure the bioavailability and thereby extending its umbrella of application.

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# Cureit<sup>®</sup>

Complete Natural Turmeric Matrix

## WORLD'S FIRST ONLY CURCUMIN



that offers  
**Complete  
Natural  
Turmeric  
Matrix**



### Benefits

10X fold increase  
in bioavailability

Bioefficient Curcumin with  
Assured Biological Activity

Pharmacological & Therapeutic  
benefits assured

100% solvent free

## CURCUMIN APPLICATIONS



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