

COMPOSITIONS USEFUL IN THE PREVENTION AND/OR TREATMENT OF INFLAMMATION AND PAIN

Technical field of invention

The present invention relates to compositions comprising an extract of *Curcuma longa*, curcumin or phospholipid-complexed curcumin; a lipophilic extract of *Zingiber officinale*; and a lipophilic extract obtained from plants containing isobutylamides of polyunsaturated fatty acids, which are useful in the prevention and/or treatment of inflammation and pain.

Prior art

Peripheral inflammations, especially those associated with joint wear, osteoarthritis, rheumatoid arthritis and psoriatic arthritis, are among the main causes of disability in middle-aged and elderly persons.

Said disorders have very different etiologies. In some cases they are autoimmune disorders, and in others disorders due to mechanical wear on the main joints which undergo constant stress, especially when the individual is overweight.

Osteoarthritis (OA) is a degenerative disease characterised by synovial alterations and destruction of joint cartilage and subchondral bone. This condition affects and debilitates about 10% of the population between 65 and 73 years old.

Treatments for rheumatoid arthritis and psoriatic arthritis exist, although they are unpleasant and debilitating, while no specific treatment currently exists for osteoarthritis.

The first-line medicaments are still non-steroidal anti-inflammatory drugs (NSAIDs) with a symptomatic action, which are often poorly tolerated by patients.

The classic anti-inflammatories, from high-dose aspirin to those of the latest generation, necessarily involve lengthy treatments and serious side effects, especially at gastric level, and also, as recently discovered, at cardiac and vascular level.

This is one reason why the consumption of OA supplements has grown

exponentially in recent years. Said supplements are substantially preparations based on chondroitin sulphate, glucosamine or hyaluronic acid, diacerein and unsaponifiable fractions of some oils, and are always used in combination with major drugs to reduce pain. All these products, and numerous other products of plant
5 origin, are used, but one of the problems involved is their poor level of pain reduction, which forces patients to use the above-mentioned painkillers.

In the case of rheumatoid arthritis, which certainly constitutes the greatest cause of disability and loss of quality of life, and osteoarthritis, there is a need for new products which, while offering therapeutic efficacy, also provide better
10 tolerability of the treatment.

Lipophilic extracts derived from medicinal plants, such as extracts of *Zingiber officinale*, *Echinacea* spp., *Zanthoxylum bungeanum*, *piperitum* or *armatum* and *Acmella oleracea*, are known to perform, on topical or systemic application, an anti-inflammatory and analgesic action associated with the presence
15 of isobutylamides of unsaturated fatty acids, which are ligands of cannabinoid receptors CB1 and CB2 and vanilloids, and in particular act as TRPV1 agonists. Their anti-inflammatory activity is known to be modest compared with that of steroidal and non-steroidal anti-inflammatories.

Curcuma longa extracts are widely used in their countries of origin, and in
20 the therapeutic context have been used to treat indigestion, flatulence, diarrhoea and joint pain. Many of these activities have been confirmed *in vitro* or in pharmacology, but little has been done at clinical level, where the data are contradictory. The active constituent of the plant is believed to be curcumin, which is currently undergoing numerous biochemical, pharmacological and clinical tests to identify its real
25 activity, and hundreds of publications describe its potential benefits.

Preliminary clinical trials have demonstrated the very low systemic absorption of curcumin, partly due to the instability of the molecule at a physiological pH. Its low bioavailability does not allow any correlation with the *in*

vitro tests (the plasma concentrations in humans are around 50 ng, including the secondary metabolites, after oral administration of 12 g).

WO2015/124616 describes compositions containing an extract of *Curcuma* spp., optionally as curcumin in the form of a complex with phospholipids, and an
5 extract selected from *Echinacea extract* spp. and lipophilic extract of *Zanthoxylum* spp., for use in the topical and systemic treatment of peripheral pain and of superficial and deep inflammatory and painful states.

There is still a need to identify further alternative products which are useful in the prevention and/or treatment of inflammation and pain, especially
10 osteoarticular inflammation and pain.

Summary of the invention

The present invention relates to compositions comprising:

- a) an extract of *Curcuma longa*, curcumin or phospholipid-complexed curcumin;
- 15 b) a lipophilic extract of *Zingiber officinale*; and
- c) a lipophilic extract obtained from plants containing isobutylamides of polyunsaturated fatty acids selected from the group consisting of *Echinacea* spp. extract, *Zanthoxylum* spp. extract and *Acmella oleracea* (*Spilanthes oleracea*) extract.

20 The present invention also relates to the use of said compositions in the prevention and/or treatment of inflammation and pain.

Detailed description of the invention

It has surprisingly been found that compositions comprising an extract of *Curcuma longa*, curcumin or phospholipid-complexed curcumin; a lipophilic extract
25 of *Zingiber officinale*; and an extract obtained from plants containing isobutylamides of polyunsaturated fatty acids, are effective in the prevention and/or treatment of inflammation and pain, especially osteoarticular inflammation and pain.

The present invention relates to compositions containing:

- a) an extract of *Curcuma longa*, curcumin or phospholipid-complexed curcumin;
- b) a lipophilic extract of *Zingiber officinale*; and
- c) a lipophilic extract obtained from plants containing isobutylamides of polyunsaturated fatty acids selected from the group consisting of *Echinacea* spp. extract, *Zanthoxylum* spp. extract and *Acmella oleracea* (*Spilanthes oleracea*) extract.

According to a preferred aspect, the *Echinacea* spp. extract can be obtained from *Echinacea angustifolia* or *purpurea*; the *Zanthoxylum* spp. extract can be obtained from *Zanthoxylum bungeanum*, *Zanthoxylum piperitum* or *Zanthoxylum armatum*, and is preferably a *Zanthoxylum bungeanum* extract.

The *Curcuma longa* extract is preferably obtained from the tubers, and is more preferably an alcoholic extract.

The lipophilic extract of *Zingiber officinale* is preferably obtained from the roots and rhizomes. The extract also preferably has a high content of gingerols and shogaols, and a *Zingiber officinale* extract with a gingerols and shogaols content ranging from 20 to 30% w/w, preferably of 25% w/w, is particularly preferred.

Echinacea spp., *Zanthoxylum* spp. or *Acmella oleracea* (*Spilanthes oleracea*) extracts can be obtained by extraction with aprotic solvents from the fruit or parts of the respective plants normally used for extraction.

Lipophilic extracts of *Echinacea* spp., *Zanthoxylum* spp., *Zingiber officinale* and *Acmella oleracea* can be obtained by extraction from the roots or rhizomes with alcohols, ketones or aliphatic ethers or, preferably, with carbon dioxide under supercritical conditions according to EP0464298 A1 (page 2 lines 1-52, and page 5 line 45 to page 6 line 7). The lipophilic extract of *Zanthoxylum* spp. can be prepared in accordance with WO 00/02570 A1 (page 1 line 26 to page 2 line 13, and page 4 line 28 to page 7 line 21).

According to a preferred aspect of the invention, the compositions comprise:

- a) phospholipid-complexed curcumin;
- b) a lipophilic extract of *Zingiber officinale*; and
- c) a lipophilic extract of *Echinacea* spp., *Zanthoxylum* spp. or *Acmella oleracea* (*Spilanthes oleracea*), preferably a *Zanthoxylum* spp. extract, and even
5 more preferably a *Zanthoxylum bungeanum* extract.

The compositions according to the invention for oral administration can comprise, per unit dose:

- a) phospholipid-complexed curcumin in amounts ranging from 50 to 1000 mg,
- 10 b) a lipophilic extract of *Zingiber officinale* in amounts ranging from 10 to 80 mg,
- c) a lipophilic extract of *Zanthoxylum* spp. in amounts ranging from 1 to 50 mg or alternatively, a lipophilic extract of *Echinacea* spp. or *Acmella oleracea* (*Spilanthes oleracea*) in amounts ranging from 5 to 50 mg.

15 According to a particularly preferred aspect, the compositions for oral administration comprise 250 mg of phospholipid-complexed curcumin, 50 mg of lipophilic extract of *Zingiber officinale* and 10 mg of lipophilic extract of *Zanthoxylum* spp. per oral unit dose.

20 According to a further aspect, the compositions according to the invention for topical administration can comprise:

- a) phospholipid-complexed curcumin in amounts ranging from 0.1 to 0.5 w/w,
- b) a lipophilic extract of *Zingiber officinale* in an amount of 0.5% w/w, and
- 25 c) a lipophilic extract of *Zanthoxylum* spp. in amounts ranging from 0.1 to 1% w/w, preferably 0.5% w/w.

According to a particularly preferred aspect, the compositions for topical administration comprise 0.05% w/w of phospholipid-complexed curcumin, 0.5%

w/w of lipophilic extract of *Zanthoxylum* spp. and 0.5% w/w of lipophilic extract of *Zingiber officinale*.

The present invention relates to compositions comprising:

- a) an extract of *Curcuma longa*, curcumin or phospholipid-complexed curcumin;
- b) a lipophilic extract of *Zingiber officinale*; and
- c) a lipophilic extract obtained from plants containing isobutylamides of polyunsaturated fatty acids selected from the group consisting of *Echinacea* spp. extract, *Zanthoxylum* spp. extract and *Acmella oleracea* (*Spilanthes oleracea*) extract;

for use in the prevention and/or treatment of inflammation and pain.

The compositions according to the invention have proved useful in the prevention and/or treatment of peripheral pain of all kinds, such as diabetic neuropathy and muscle pain of different origins, and inflammatory states, such as skin inflammations of different origins.

The compositions have proved particularly effective in the treatment of osteoarticular inflammation and pain, e.g. peripheral and systemic pain, especially in the small and large joints.

The compositions according to the invention exhibit a potent analgesic and anti-inflammatory activity, greater than that found when the extracts are used separately, thus demonstrating a synergistic effect.

The ingredients of the composition according to the invention, when taken individually, exhibited modest efficacy, whereas when suitably combined they gave rise to a totally different profile in terms of tolerability and efficacy, exhibiting a synergic effect.

Formulations comprising the compositions according to the invention can be obtained by conventional techniques as described, for example, in "Remington's Pharmaceutical Handbook", Mack Publishing Co., N.Y., USA. In particular, the

compositions according to the invention can be formulated by conventional formulation techniques used for plant ingredients, which require particular care to be taken to avoid interactions with the excipients and the capsule matrices.

The compositions according to the invention can be administered topically or orally.

Examples of oral formulations are tablets, dragées, soft and hard gelatin capsules, and cellulose capsules.

The compositions according to the invention can preferably be formulated in the form of soft capsules or emulsions.

The compositions according to the invention can be administered in combination with other products useful in the prevention and/or treatment of joint inflammation and pain.

The examples below further illustrate the invention.

Examples

Example 1

Soft gelatin capsules containing the following were prepared:

Phospholipid-complexed curcumin	200.00 mg
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<i>Zingiber officinale</i> lipophilic extract (25% gingerols)	50.00 mg
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<i>Zanthoxylum bungeanum</i> extract	15.00 mg
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extracted with CO₂ standardized to 25% in isobutylamides

Linseed oil	q.s. to 600 mg
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Example 2

Soft gelatin capsules containing the following were prepared:

Phospholipid-complexed curcumin	300.00 mg
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<i>Zanthoxylum piperitum</i> extract	15.00 mg
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extracted with CO₂ standardized to 25% in isobutylamides

<i>Zingiber officinale</i> extract (25% gingerols)	50.00 mg
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Linseed oil	q.s. to 700 mg
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Example 3 - Test of *in vivo* activity in laboratory animal (rat): Tail-flick test in the rat

The analgesic activity of a composition according to the invention comprising phospholipid-complexed curcumin, *Zingiber officinale* extract and *Zanthoxylum*
5 *bungeanum* extract according to example 1 was compared with that of the individual ingredients administered separately in the rat and with that of a composition according to WO2015/124616 comprising phospholipid-complexed curcumin and a *Zanthoxylum bungeanum* extract in the same amounts of those used in the composition described in example 1 of the present invention.

10 The results demonstrated a clear synergy between the three ingredients of the compositions according to the invention, as shown in Table 1 below.

The analgesic activity was evaluated with the tail-flick test in the rat. Before treatment, three basic measurements were conducted on the animals to ensure that they were suitable for the handling and apparatus involved. The parameters used
15 were 15V of radiant heat and a 15-second cut-off (to prevent irreversible harm to the animals), with evaluation of the tail-flick.

The animals were treated with 100 mg/Kg of the composition of example 1.

The same experimental model was used to evaluate the three individual ingredients of the composition, in three separate formulations, each containing one
20 of the three active ingredients present in the composition described in example 1, in the same amount.

The control animals were treated with 0.1 ml of the oil used to dissolve the ingredients (carrier).

The analgesic effect was measured 15 and 30 min. after administration.

Table 1

Treatment	Dose mg/Kg	Latency time			
		after 15 min	% increase	after 30 min	% increase
Carrier	--	4.1 ± 0.20	--	4.3 ± 0.35	--
Composition described in example 1	100	13.6 ± 0.49	223.8	9.7 ± 0.13	125.6
<i>Zanthoxylum bungeanum</i> lipophilic extract	2.5	5.9 ± 0.26	43.9	5.1 ± 0.63	18.6
Phospholipid- complexed curcumin	33.3	4.2 ± 0.17	2.4	4.4 ± 0.43	2.3
<i>Zingiber officinale</i> lipophilic extract (25% gingerols)	8.3	4.3 ± 0.15	2.4	4.2 ± 0.21	--
Composition according to WO2015/124616	100	9.8 ± 0.21	151.3	6.5 ± 0.22	58.5

Example 4 – Evaluation of analgesic activity in humans

40 patients suffering from knee joint disorders with constant pain were
 5 randomised and treated with two tablets a day according to example 1, one in the
 morning and one in the evening, or with placebo (consisting of the carrier alone).

Efficacy was scored on an international analogue pain scale with scores from
 0 to 10, 10 points indicating maximum pain and 0 the disappearance of pain. The
 effect was evaluated on the second day after administration of the tablet, in the
 10 mornings 60 and 120 minutes after treatment.

The results are set out in Table 2 below.

Table 2

Treatment	Pain (scores) at time		
	0	60 min.	120 min.
Placebo	9.3 ± 1.6	9.1 ± 1.2	8.9 ± 1.3
Composition described in example 1	9.4 ± 1.9	4.7 ± 0.2	2.9 ± 1.6

Table 3 shows the results obtained, following treatment for up to three months with the composition according to the invention, on the global effect of osteoarthritis in patients recruited on the basis of the Karnofsky index (J. Clin. Oncology 1984; 2:187-193).

5 The evaluation was conducted by measuring the distance travelled without pain, and with different degrees of pain, on a treadmill set to 3 Km/h and an inclination of 10%. 80 patients suffering from osteoarthritis of the knee were divided into two groups. After randomisation, one group was treated with the placebo and the other with the composition described in example 1. During the treatment, pain
10 was evaluated weekly with WOMAC, and the humoral parameters, which indicate the inflammatory parameters, were evaluated monthly, and they were found to have improved.

Table 3. Results of distance travelled on treadmill

Treatment	Distance travelled at time		
	0	1 month	3 months
Placebo	74.6 metres	86.1 metres	xx
Composition described in example 1	75.1 metres	165.6 metres	355 metres

15 xx patients who left the trial for ethical reasons or were treated with other medicaments.

 The combination of the oral and topical formulations proved effective in the clinical field, especially on patients suffering with knee joint disorders. The topical formulations proved particularly useful in the treatment of peripheral pain and of
20 superficial and deep inflammatory and painful states. The combination can be applied directly to the skin in the oil wherein it is solubilised, or incorporated in creams or ointments suitable for administration. The treatment can be performed one to three times a day, applying a dose of 0.5-5 g of the topical formulation to the part of the body affected by the painful disorder.

CLAIMS

1. A composition comprising:
 - a) curcumin complexed with phospholipids;
 - 5 b) a lipophilic extract of *Zingiber officinale*; and
 - c) a lipophilic extract of *Zanthoxylum spp.*.

2. The composition according to claim 1, comprising per unit dose for oral administration:
 - 10 a) curcumin complexed with phospholipids in amounts ranging from 50 to 1000 mg,
 - b) a lipophilic extract of *Zingiber officinale* in amounts ranging from 10 to 80 mg,
 - c) a lipophilic extract of *Zanthoxylum spp.* in amounts ranging from 1 to 50
15 mg.

3. The composition according to claim 2, comprising per unit dose for oral administration:
 - a) 250 mg of curcumin complexed with phospholipids;
 - 20 b) 50 mg of lipophilic extract of *Zingiber officinale*; and
 - c) 10 mg of lipophilic extract of *Zanthoxylum spp.*.

4. The composition according to claim 1, for topical administration comprising:
 - 25 a) curcumin complexed with phospholipids in amounts ranging from 0.1 to 0.5% w/w,
 - b) a lipophilic extract of *Zingiber officinale* in an amount of 0.5% w/w, and
 - c) a lipophilic extract of *Zanthoxylum spp.* in amounts ranging from 0.1 to 1% w/w, preferably of 0.5% w/w.
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5. The composition according to claim 1, comprising:
 - a) 0.05% w/w of curcumin complexed with phospholipids,

- b) 0.5% w/w of lipophilic extract of *Zingiber officinale*, and
- c) 0.5% w/w of lipophilic extract of *Zanthoxylum spp.*.

6. The composition according to claims 1-5, wherein the extract of
5 *Zanthoxylum spp.* is obtained from *Zanthoxylum bungeanum*, *Zanthoxylum piperitum* or *Zanthoxylum armatum*.

7. The composition according to claim 6, wherein the extract of *Zanthoxylum spp.* is an extract of *Zanthoxylum bungeanum*.

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8. The composition according to claims 1-7, wherein the extract of *Zingiber officinale* has a gingerols and shogaols content ranging from 20 to 30% w/w, preferably of 25% w/w.

15 9. The composition according to claims 1-8, for use in prevention and/or treatment of inflammation and pain.

10. The composition for use according to claim 9, wherein the inflammation and pain are osteoarticular.

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11. Use of the composition according to any one of claims 1-8 in the manufacture of a medicament for prevention and/or treatment of inflammation and pain.

25 12. The use according to claim 11, wherein the inflammation and pain are osteoarticular.