Cover Page

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf

DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in

BIOLOGICAL SCREENING OF ANTI-INFLAMMATORY AGENT

Mr. Rakesh Kumar Gupta

Abstract

Plant represents the main source of molecules for the development of new drugs, which intensities the interest of transactional industry in searching for substance obtained from plant source, especially since the vast majority of species have not been studies chemically or biologically particularly concerning anti-inflammatory action.

Anti-inflammatory drugs can in the pathological process of inflammatory to minimize tissue damage and provide greater comfort to the patient.

Although many review articles have been published in this regard, the majority presented the subject from a limited regional perspective. Though the current article present highlight forms the published literature on biological screening of Anti-inflammatory Agent.

Keywords: Intensities, Anti-Inflammatory, Pathological.

INTRODUCTION

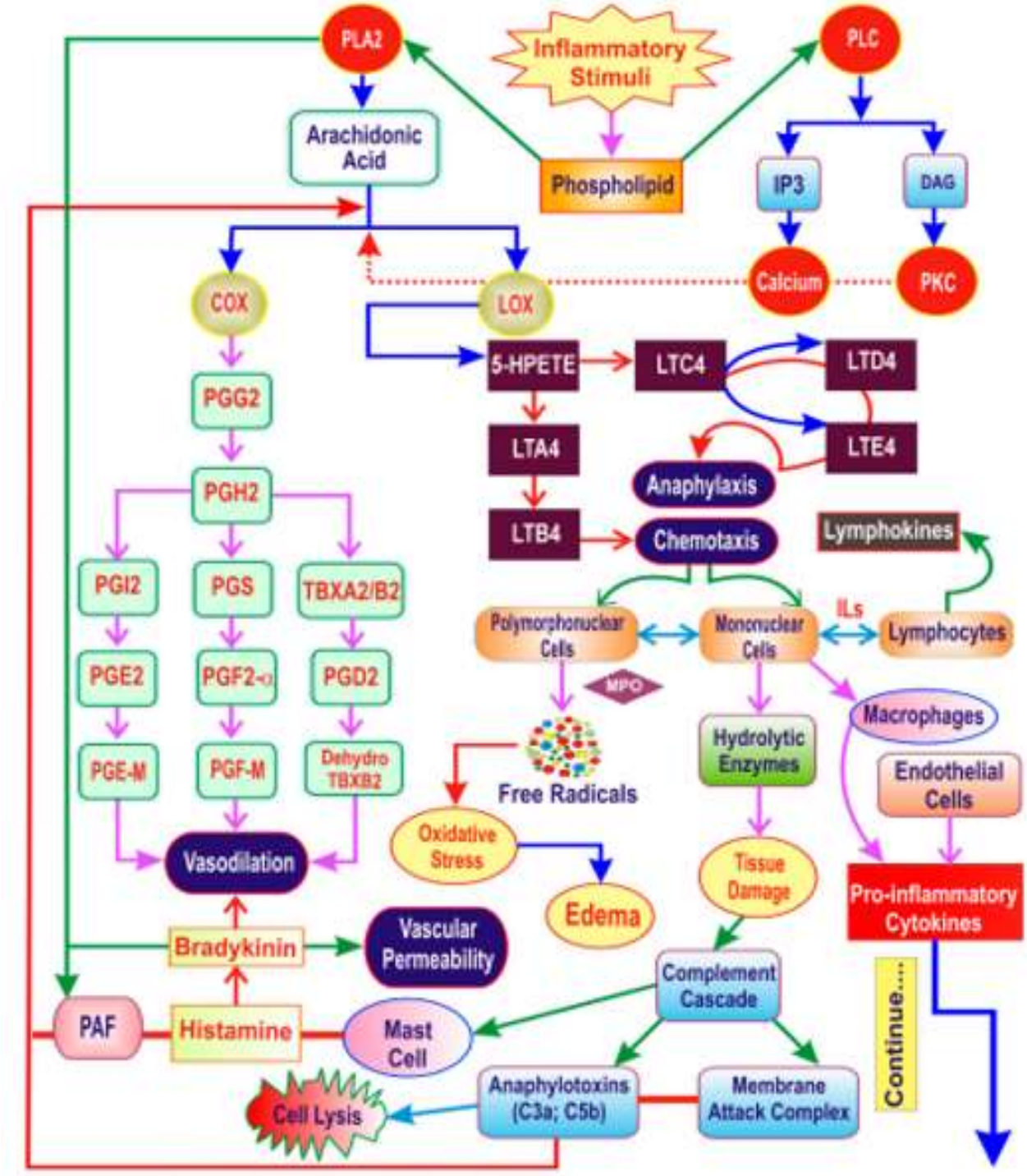
WHO has identified 2000-2010 as the decade for musculoskeletal disorders. Herbal drugs like holy basil (tulsi;Ocimum sanctum), turmeric (Curcuma longa), Indian olibanum tree (Boswellia serrata), ginger (Zingiber officnale), etc.are widely used for the treatment of various inflammatory disorders. They are not only found to be safer and have fewer side effects, but they also cover a large domain of mechanisms involved in inflammation thus proving to be more beneficial than synthetic drugs, Inflammation expresses the response to damage of cells and vascular tissues. The five basic symptoms of inflammation-redness, swelling, heat, pain, and deranged function, have been known since the ancient Greek and Roman era. The major events occurring during this response are an increased blood supply to the affected tissue by vasodilation, increased capillary permeability caused by retraction of the endothelial cells which allows the soluble mediators of immunity to reach the site of inflammation and leukocytes migration out of the capillaries into the surrounding tissues. Neutrophils, monocytes, and lymphocytes also migrate towards the site of infection. The development of inflammatory reactions is controlled by the following systems: cytokines, complement, kinin and fibrinocytic pathways; by ipid mediators (prostaglandins and leukotrienes) released from different cells; and by vasoactive mediators released from mast cells, basophils, and platelets. The response is accompanied by the clinical signs of erythema, oedema, hyperalgesia, and pain. Inflammatory responses occur-in three distinct phases, each apparently mediated by different mechanisms. Acute transient phase. Characterized by local vasodilatation and increased capillary permeability. Sub-acute phase: Characterized by infiltration of leukocytes and phagocytic cells. Chronic proliferative phase: Tissue degeneration and fibrosis occur. Drugs preventing acute and sub-acute inflammation can be tested using the following models: paw oedema in rats, croton oil ear oedema, pleurisy tests, UV-erythema in guinea pigs, oxazolone-induced ear oedema in mice, granuloma pouch technique, and vascular permeability. The effectiveness of drugs which work at the proliferative phase can be measured by methods for testing granuloma formation, such as the cotton pellet granuloma, adjuvantnduced arthritis, glass rod granuloma, and PVC sponge granuloma.

Cover Page

DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf

The Inflammatory Cascade



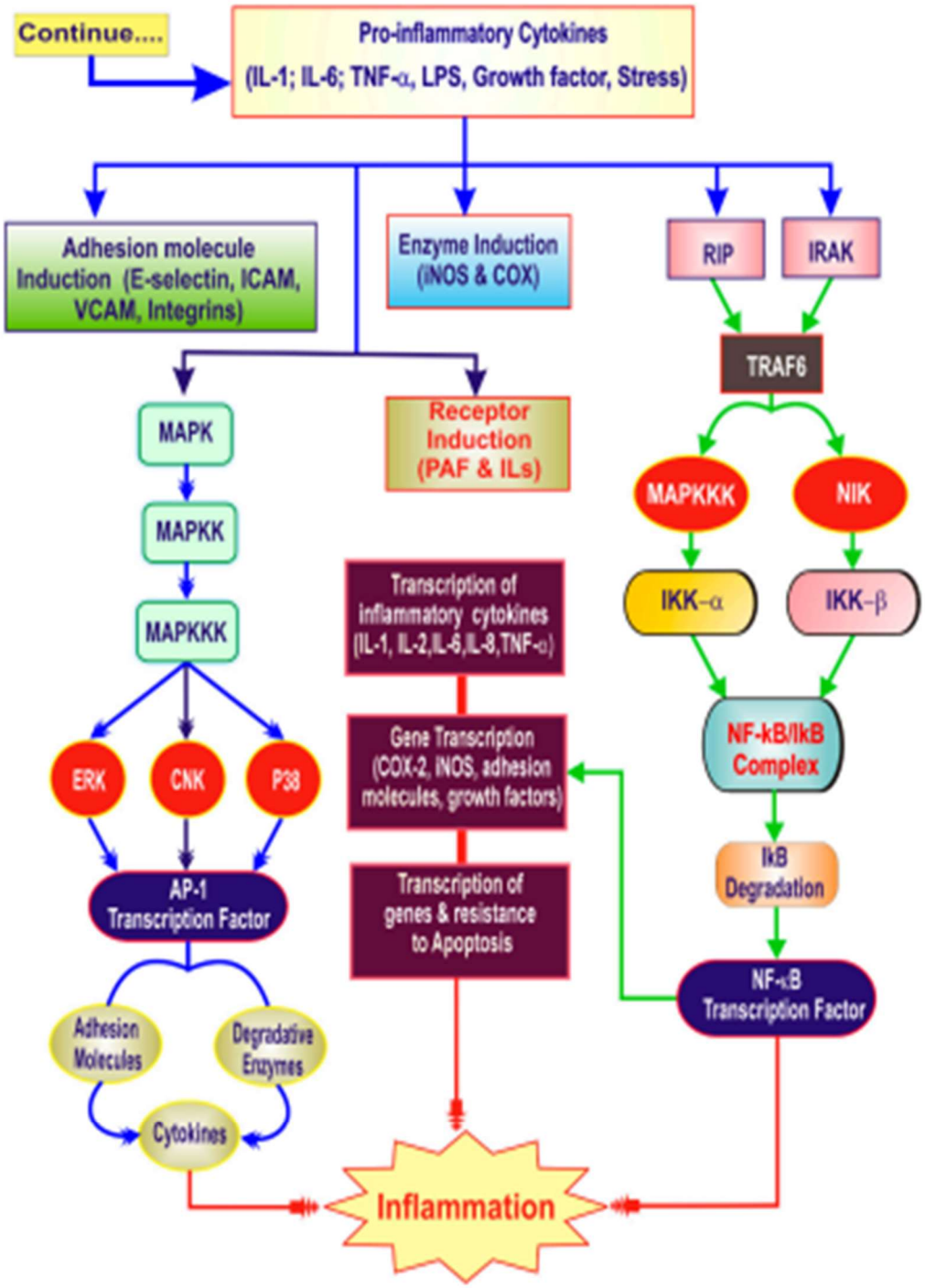
(A)

Figure 1. *Cont.*

Cover Page

DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf



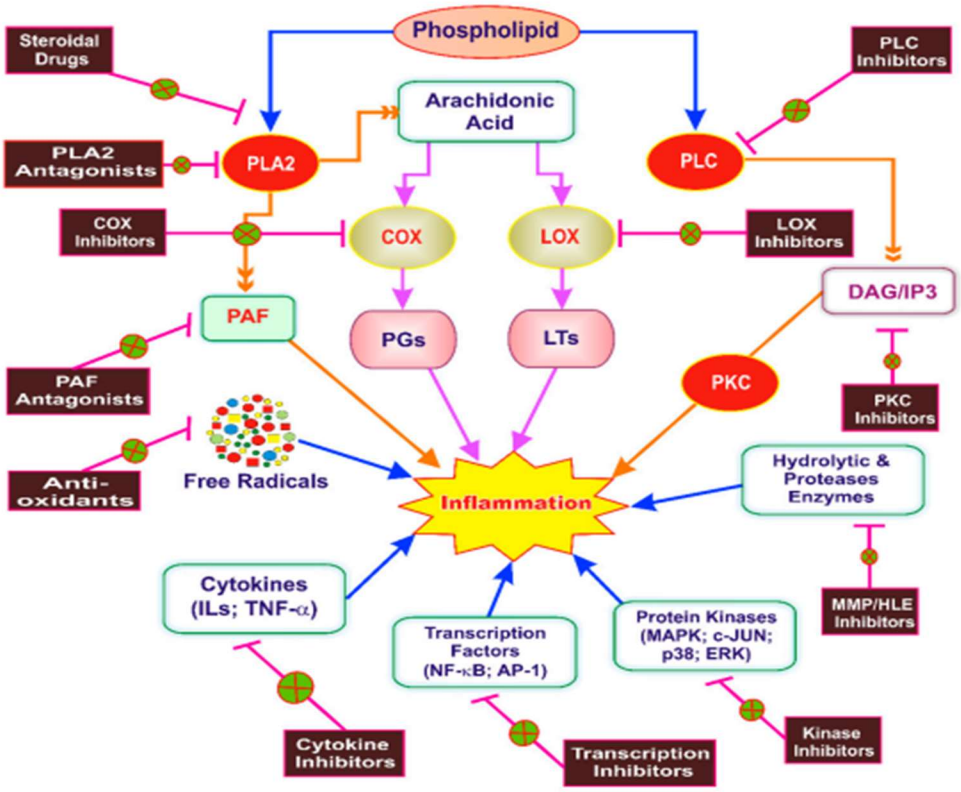
(B)

Figure 1. (A) The inflammatory cascade; (B) The inflammatory cascade. The arrows in the figure represents process. The arrows in the figure represents process

Cover Page

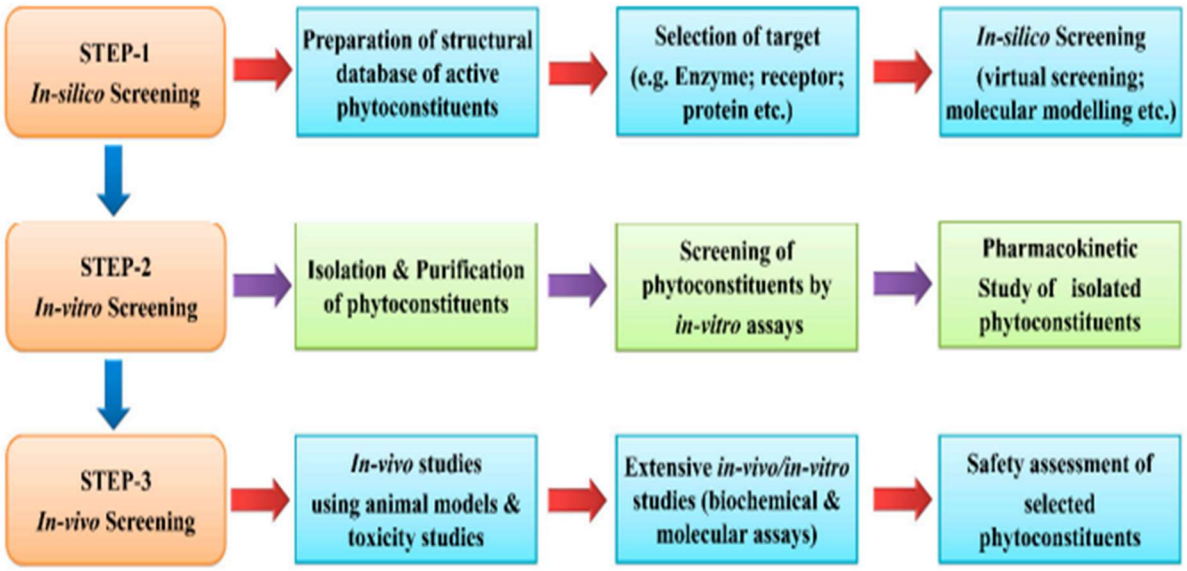
DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf



A systematic approach for preclinical evaluation of phytoconstituents.

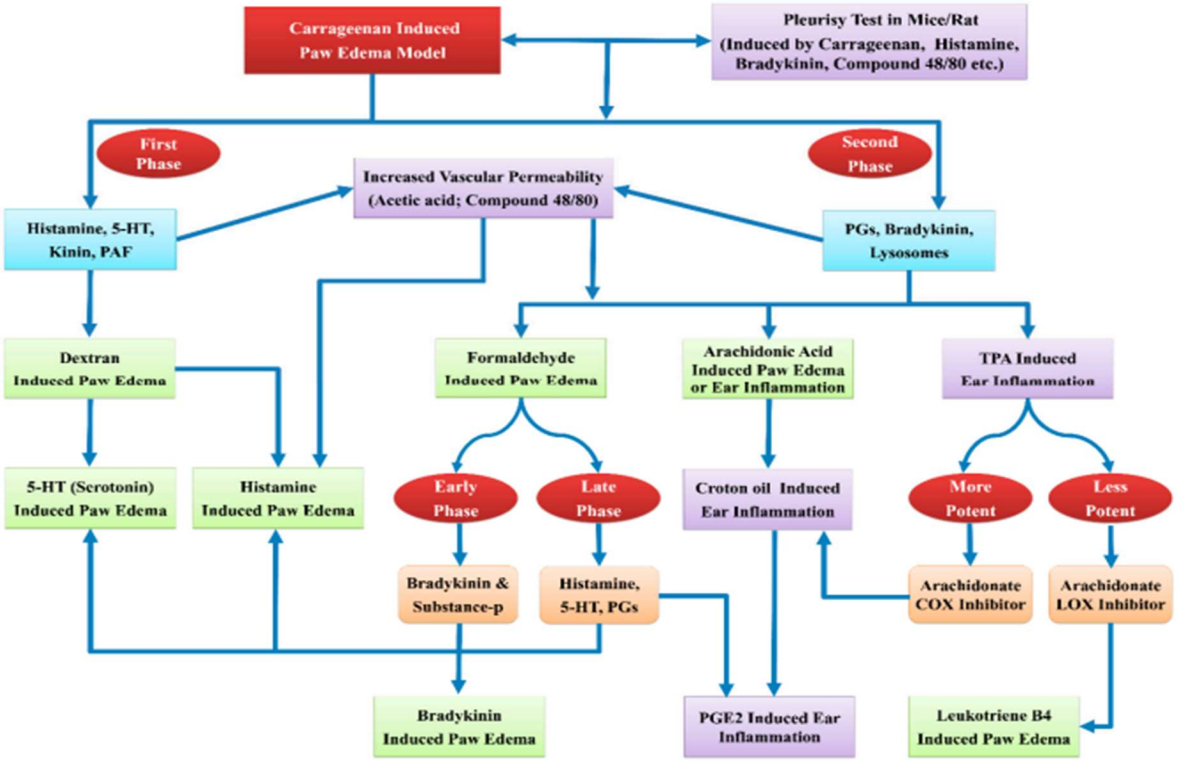
Scheme for the preclinical evaluation of the acute anti-inflammatory activity.



Cover Page

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf

DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in



Testing of Drugs Preventing Acute and Sub-Acute Inflammation

Paw oedema

This technique is based upon the ability of anti-inflammatory agents to inhibit the oedema produced in the hind paw of the rat after injection of a phlogistic agent (irritant). Rats with a body weight between 100 and 150 g are required. Many irritants have been used, such as brewer's yeast, formaldehyde, dextran, egg albumin, kaolin, Aerosil, and sulphated polysaccharides like carrageenan. The animals are fasted overnight. The control rats receive distilled water while the test animals receive drug suspension orally. Thirty minutes later, the rats are subcutaneously injected with 0.1 ml of 1% solution of carrageenan in the foot pad of the left hind paw. The paw is marked with ink and immersed in the water cell of a plethysmometer up to this mark. The paw volume is measured plethysmographically immediately after injection, 3 and 6 h after injection, and eventually 24h after injection. The paw volumes for the control group are then compared with those of the test group.

Croton oil ear oedema in rats and mice

This method mainly evaluates the antiphlogistic activity of topically applied steroids. For this method, mice (22 g) or rats (70 g) are required. For tests in mice, the irritant is composed of (v/v): 1 part croton oil, 10 parts ethanol, 20 parts pyridine, and 69 parts ethyl ether: for rats the irritant is composed of (viv): 4 parts croton oil, 10 parts cthanol, 20 parts pyridine, and 66 parts ethyl ether. The standard and the test compound are dissolved in this solution. Irritants are applied on both sides of the right car (0.01 ml in mice or 0.02 ml in rats under ether anaesthesia). Controls receive only the irritant solvent. The left ear remains untreated. Four hours after application, the animals are sacrificed under anaesthesia. Both cars are removed and discs of 8 mm diameter are cut. The discs are weighed immediately and the weight difference between the treated and untreated ear is recorded indicating the degree of inflammatory oedema.

Pleurisy test

Pleurisy is the phenomenon of exudative inflammation in man. In experimental animals, pleurisy can be induced by several irritants, such as carrageenan, histamine, bradyki- nin prostaglandins. mast cell degranulators, and dextran. Leukocytes migration and various biochemical parameters involved in the inflammatory response can be measured easily in the exudate. Male rats weighing 220-260 g are required. The animal is lightly anaesthetized with ether and placed on its back. The hair from the skin over the ribs on the right side is removed and the region cleaned with alcohol. A small incision is made into the skin under the right arm. The wound is

Cover Page

DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf

opened and 0.1 ml of 2% carrageenan solution is injected into the pleural cavity through this incision. The wound is closed with a clip. One hour before this injection and 24 and 48 h thereafter, rats are treated (subcutaneously ororally) with the standard or the test compound. A control group receives only the vehicle. The animals are sacrificed 72 h after carrageenan injection and pinned on a dissection board with the forelimbs fully extended. About 1 ml of heparinized Hank's solution is injected into the pleural cavity through an incision. The cavity is gently massaged to mix its contents. The fluid is aspirated out of the cavity using a pipette. The aspirated exudates are collected in a graduated plastic tube. About 1 ml (the added Hank's solution) is subtracted from the measured volume. The values of each experimental group are averaged and compared with the control group. The white blood cell number in the exudate is measured using a Coulter counter or a hacmatocytometer.

Ultraviolet erythema in guinea pigs

Antiinflammatory agents delay the development of ultraviolet erythema on albino guinea pigs. They are shaved on the back 18 h before testing. The test compound is suspended in the vehicle and half the dose of the test compound is administered orally 30 min before ultraviolet exposure. Control animals are treated with the vehicle alone. The guinea pigs are placed in a leather cuff with a hole of 1.5-2.5 cm size punched in it, allowing the ultraviolet radiation to reach only this area. An ultraviolet burner is warmed up for about 30 min before use and placed at a constant distance (20 cm) above the animal. Following a 2 min ultraviolet exposure, the remaining half of the test compound is administered. The erythema is scored 2 h and 4 h after exposure.

Oxazolone-induced ear oedema in mice

The oxazolone-induced car oedema in mice is a model of delayed contact hypersensitivity that permits the quantitative evaluation of the topical and systemic anti-inflammatory activity of a compound following topical administration. Mice of either sex (25 g) are required. A fresh 2% solution of oxazolone in acetone is prepared. This solution (0.01ml) is injected on the inside of both cars under anaesthesia. The mice are injected 8 days later, again under anaesthesia, with 0.01 ml of 2% oxazolone solution (control) or 0.01 ml of oxazolone solution in which the test compound or the standard is dissolved, on the inside of the right car. The left ear remains untreated. The maximum of inflammation occurs 24 h later. At this time the animals are sacrificed under anaesthesia and a disc of 8 mm diameter is punched from both cars. The discs are immediately balance. The weight difference is an indicator of the inflammatory oedema.

Granuloma pouch technique

Irritants such as croton oil or carrageenan produce aseptic inflammation resulting in large volumes of exudate, which resembles the sub-acute type of inflammation. Rats (150-200g) are selected for the study; the back of the animals is shaved and disinfected. With a very thin needle, an air pouch is made by injection of 20 ml of air under ether anaesthesia. Into the resulting air pouch 0.5 ml of a 1% solution of croton oil in sesame oil is injected. After 48 h, the air is withdrawn from the pouch and 72 h later any resulting adhesions are broken. Instead of croton oil, 1 ml of a 20% suspension of carrageenan in sesame oil can be used as irritant. Starting with the formation of the pouch, the animals are treated every day either orally or subcutaneously with the test compound or the standard. On the fifth day, the animals are sacrificed under anaesthesia. The pouch is opened and the exudate collected in glass cylinders. The average value of the exudate of the controls and the test groups is calculated.

Vascular permeability

This test is used to evaluate the inhibitory activity of drugs against increased vascular permeability, which is induced by a phlogistic substance. Mediators of inflammation, such as histamine, prostaglandins, and leucotrienes are released following stimulation of mast cells. This leads to a dilation of arterioles and venules and to an increased vascular permeability. As a consequence, fluid and plasma proteins are released and edemas are formed. Vascular permeability is increased by subcutaneous injection of the mast celldegranulating compound 48/80. The increase of permeability can be recognised by the infiltration of the injected sites of the skin with the dye Evan's blue.Male rats (160 and 200 g) are used. About 5 ml/kg of 1% solution of Evan's blue is injected intravenously. One hour later, the animals are dosed with the test compound orally or intraperitoneally. After 30 min, the animals are lightly anaesthetized with ether and 0.05 ml of 0.01% solution of compound 48/80 is injected subcutaneously at three sites. About 90 min after the injection of compound 48/80, the animals are sacrificed by ether anaesthesia. The abdominal skin is removed and the dye-infiltrated areas of the skin measured. The percent inhibition in the created animals as compared to the control group is calculated.

Testing of Drugs Preventing the Proliferative Phase (Granuloma Formation) of Inflammation
Cotton pellet granuloma

Cover Page

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf

DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in

Foreign body granulomas are induced in rats by the subcutaneous implantation of pellets of compressed cotton. After several days, histologically giant cells and undifferentiated connective tissue can be observed besides fluid infiltration. The amount of newly formed connective tissue can be measured by weighing the dried pellets after removal. More intensive granuloma formation has been observed if the cotton pellets are impregnated with carrageenan. Male and female rats with an average weight of 200 g are used. The back skin is shaved and disinfected with 70% ethanol. An incision is made in the lumbar or neck region. Subcutaneous tunnels are formed and a sterilized cotton pellet is placed with the help of a blunted forceps. The animals are treated for seven days subcutaneously or orally. They are then sacrificed, the pellets taken out and dried. The net dry weight, that is, after subtracting the weight of the cotton pellet is determined. The average weight of the pellets of the control group as well as that of the test group is calculated. The percent change of granuloma weight relative to the vehicle control group is determined.

Adjuvant arthritis in rats

Adjuvant-induced arthritis in rats exhibit many similarities to human rheumatoid arthritis. An injection of complete Freund's adjuvant into the rat's paw induces inflammation as a primary lesion with a maximum inflammation after three to five days. Secondary lesions occur after a delay of approximately 11 to 12 days and are characterized by inflammation of noninjected sites (hind legs, forepaws, ears, nose, and tail), a decrease in weight and immune responses. Male rats with an initial body weight of 130 to 200 g arc used. On day 1, rats are injected in the sub-plantar region of the left hind paw with 0.1 ml of complete Freund's adjuvant. The adjuvant consists of 6 mg mycobacterium butyricum thoroughly ground with a mortar and pestle and suspended in heavy paraffin oil (Merck) to give a concentration of 6 mg/ml. Dosing with the test compounds orthe standard is started on the same day and continued for 12 days. Both paw volumes and body weight are recorded on the day of injection. The paw volume is measured plethysmographically with equipment as described in the. paw oedema tests. On day 5, the volume of the injected paw is measured again, indicating the primary lesion and the influence of therapeutic agents on this phase. The severity of the induced adjuvant disease is determined by measuring the noninjected paw (secondary lesions) with a plethysmometer. The animals are not dosed with the test compound or the standard from day 12 to 21. On day 21, the body weight is determined again and the severity of the secondary lesions evaluated visually and graded according to the following scheme:

Ears:	absence of nodules and redness	0
	presence of nodules and redness	1
Nose:	no swelling of connective tissue	0
	intensive swelling of connective tissue	1
Tail:	absence of nodules	0
	presence of nodules	1
Forepaws:	absence of inflammation	0
	inflammation of at least I joint	1
Hind paws:	absence of inflammation	0
	slight inflammation	1
	moderate inflammation	2
	marked inflammation	3

Sponge implantation technique

Foreign body granulomas are induced in rats by subcutaneous implantation of a sponge. Sponges used for implantation are prepared from polyvinyl foam sheets (thickness: 5mm). Discs are punched out to a standard size and weight (10.0 + 0.02 mg). The sponges are then soaked in 70% v/v ethanol for 30 min., rinsed four times with distilled water, and healed at 80 C for 2 h. Before implantation in the animal, the sponges are soaked in sterile 0.9% saline in which either drugs, antigens, or irritants have been suspended. Typical examples include 1% carrageenan, 1% yeast, 1% zymosan A, 6% dextran, heat-killed Borderelhi pertussis, or 0.5% heat-killed Mycobacterium tuberculosis. Sponges are implanted in rats weighing 150-200 g under ether anaesthesia. An incision is made and separate cavities are formed into which sponges are inserted. Upto 8 sponges may be implanted per rat. The incision is closed with Michel clips and the animals maintained at a constant temperature of 24.C. For short-term experiments, the animals are treated with the test drug or standard once before implantation orally or subcutaneously. For long-term experiments, the rats are treated daily up to 3 weeks.

Glass rod granuloma

Cover Page

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf

DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in

Glass rod-induced granulomas reflect the chronic proliferate phase of inflammation. Of the newly formed connective tissue, not only can the wet and dry weight be measured, but also the chemical composition and mechanical properties. Glass rods with a diameter of 6 min are cut to a length of 40 mm and the ends rounded off. They are sterilized before implantation. Rats are anaesthetized with ether, the back skin shaved and disinfected. From an incision in the back region, a subcutaneous tunnel is formed with a blunted forceps. A glass rod is introduced into this tunnel. The incision wound is closed by sutures. The animals are kept in separate cages. The rods remain in situ for 20 or 40 days. Animals are treated orally. At the end of 20 days the animals are sacrificed. The glass rods are removed together with the surrounding connective tissue, which forms a tube around the glass rod. By incision at one end, the glass rod is extracted and the granuloma sac inverted forming a plain piece of pure connective tissue. Wet weight of the granuloma tissue is recorded. The specimens are kept in a humid chamber until further analysis. Biochemical analyses, such as determination of collagen and glycosaminoglycans, can also be performed.

Conclusions

The search for a newer anti-inflammatory agent is an ongoing pursuit and natural products appears to offer a great hope for getting better anti-inflammatory compounds. Current status of drug discovery from natural sources revealed that interest in the screening of phytoconstituents for anti-inflammatory and related activities has been increased. Several plants owe their pharmacological properties mainly due to the presence of secondary metabolites like flavonoids and triterpenoids. Many phytoconstituents has demonstrated their activities towards the multiple targets of inflammation at minute concentrations with lower incidences of toxic effects. In the context of current drug discovery scenario and advanced molecular techniques, it will be better to extrapolate the anti-inflammatory studies on already reported natural products rather than counting for newer ones. Earlier reports showed that most of the anti-inflammatory studies are either conducted using crude extracts (at higher doses) or isolated phytoconstituents. However, these studies on natural products are not extended up to the establishment of their molecular mechanisms and pharmacokinetics. Systematic screening of natural products through employment of appropriate animal models, widespread involvement of biochemical and molecular estimations, development of valid pharmacokinetic and safety data, etc. should be assimilated to explore the better anti-inflammatory leads from natural origin.

References

1. Dewanjee, S.; Dua, T.K.; Sahu, R. Potential anti-inflammatory effect of Leea macrophylla Roxb. leaves: A wild edible plant. Food Chem. Toxicol. 2013, 59, 514–520. [CrossRef]
2. Kulkarni, R.G.; Achaiah, G.; Sastry, G.N. Novel targets for antiinflammatory and antiarthritic agents. Curr. Pharm. Des. 2006, 12, 2437–2454. [CrossRef]
3. Calixto, J.B.; Otuki, M.F.; Santos, A.R.S. Anti-Inflammatory Compounds of Plant Origin. Part I. Action on Arachidonic Acid Pathway, Nitric Oxide and Nuclear Factor κ B (NF-κB). Planta Med. 2003, 69, 973–983.
4. Chung, H.-J.; Lee, H.-S.; Shin, J.-S.; Lee, S.-H.; Park, B.-M.; Youn, Y.-S.; Lee, S.K. Modulation of acute and chronic inflammatory processes by a traditional medicine preparation GCSB-5 both in vitro and in vivo animal models. J. Ethnopharmacol. 2010, 130, 450–459. [CrossRef]
5. Simmons, D.L. What makes a good anti-inflammatory drug target? Drug Discov. Today 2006, 11, 210–219. [CrossRef]
6. Debnath, S.; Ghosh, S.; Hazra, B. Inhibitory effect of Nymphaea pubescens Willd. flower extract on carrageenan-induced inflammation and CCl4-induced hepatotoxicity in rats. Food Chem. Toxicol. 2013, 59, 485–491. [CrossRef]
7. Fangkrathok, N.; Junlatat, J.; Sripanidkulchai, B. In vivo and in vitro anti-inflammatory activity of Lentinus polychrous extract. J. Ethnopharmacol. 2013, 147, 631–637. [CrossRef]
8. Aggarwal, B.B.; Shishodia, S.; Sandur, S.K.; Pandey, M.K.; Sethi, G. Inflammation and cancer: How hot is the link? Biochem. Pharmacol. 2006, 72, 1605–1621. [CrossRef]
9. Divya, T.; Latha, P.; Usha, K.; Anuja, G.; Suja, S.; Shyamal, S.; Shine, V.; Sini, S.; Shikha, P.; Rajasekharan, S. Anti-inflammatory, analgesic and anti-lipid peroxidative properties of Wattakaka volubilis (Linn. f.) Stapf. Indian J. Nat. Prod. Resour. 2009, 8, 137–141.
10. Jo, W.S.; Yang, K.M.; Choi, Y.J.; Jeong, C.H.; Ahn, K.J.; Nam, B.H.; Lee, S.W.; Seo, S.Y.; Jeong, M.H. In vitro and in vivo anti-inflammatory effects of pegmatite. Mol. Cell. Toxicol. 2010, 6, 195–202. [CrossRef]
11. Sofidiya, M.O.; Imeh, E.; Ezeani, C.; Aigbe, F.R.; Akindele, A.J. Antinociceptive and anti-inflammatory activities of ethanolic extract of Alafia barteri. Rev. Bras. De Farm. 2014, 24, 348–354. [CrossRef]
12. Kumari, K.; Weerakoon, T.; Handunnetti, S.; Samarasinghe, K.; Suresh, T. Anti-inflammatory activity of dried flower extracts of Aegle marmelos in Wistar rats. J. Ethnopharmacol. 2014, 151, 1202–1208. [CrossRef]
13. Qandil, A.M. Prodrugs of Nonsteroidal Anti-Inflammatory Drugs (NSAIDs), More Than Meets the Eye: A Critical Review. Int. J. Mol. Sci. 2012, 13, 17244–17274. [CrossRef]
14. De Oliveira, R.G.; Mahon, C.P.A.N.; Ascêncio, P.G.M.; Ascêncio, S.D.; Balogun, S.O.; Martins, D.T.D.O. Evaluation of anti-inflammatory activity of hydroethanolic extract of Dilodendron bipinnatum Radlk. J. Ethnopharmacol. 2014, 155, 387–395. [CrossRef]

Cover Page

DOI: http://ijmer.in.doi./2022/11.10.43
www.ijmer.in

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881; IMPACT FACTOR :8.017(2022); IC VALUE:5.16; ISI VALUE:2.286
Peer Reviewed and Refereed Journal: VOLUME:11, ISSUE:10(3), October: 2022
Online Copy of Article Publication Available (2022 Issues)
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: 2nd October 2022
Publication Date:10th November 2022
Publisher: Sucharitha Publication, India
Digital Certificate of Publication: www.ijmer.in/pdf/e-CertificateofPublication-IJMER.pdf

15. Gautam, R.; Jachak, S.M. Recent developments in anti-inflammatory natural products. Med. Res. Rev. 2009, 29, 767–820. [CrossRef]
16. Gorzalczany, S.; López, P.; Acevedo, C.; Ferraro, G. Anti-inflammatory effect of Lithrea molleoides extracts and isolated active compounds. J. Ethnopharmacol. 2011, 133, 994–998. [CrossRef]
17. Uddin, G.; Rauf, A.; Siddiqui, B.S.; Muhammad, N.; Khan, A.; Shah, S.U.A.; Rauf, D.A. Anti-nociceptive, anti-inflammatory and sedative activities of the extracts and chemical constituents of Diospyros lotus L. Phytomedicine 2014, 21, 954–959. [CrossRef]
18. Nagori, K.; Singh, M.K.; Dewangan, D.; Verma, V.; Tripathi, D. Anti-inflammatory activity and chemo profile of plants used in traditional medicine: A review. J. Chem. Pharm. Res. 2010, 2, 122–130.
19. Bellik, Y.; Boukraa, L.; Alzahrani, H.A.; Bakhotmah, B.A.; Abdellah, F.; Hammoudi, S.M.; Iguer-Ouada, M. Molecular Mechanism Underlying Anti-Inflammatory and Anti-Allergic Activities of Phytochemicals: An Update. Molecules 2012, 18, 322–353. [CrossRef]
20. Lipsky, P.E. The clinical potential of cyclooxygenase-2–specific inhibitors. Am. J. Med. 1999, 106, 51S–57S. [CrossRef]
21. Gupta, M.; Mazumder, U.K.; Gomathi, P.; Selvan, V.T. Antiinflammatory evaluation of leaves of Plumeria acuminata. BMC Complement. Altern. Med. 2006, 6, 36. [CrossRef]
22. Eddouks, M.; Chattopadhyay, D.; Zeggwagh, N.A. Animal Models as Tools to Investigate Antidiabetic and Anti-Inflammatory Plants. Evid.-Based Complement. Altern. Med. 2012, 2012, 142087. [CrossRef]
23. Roome, T.; Dar, A.; Naqvi, S.; Ali, S.; Choudhary, M.I. Aegiceras corniculatum extract suppresses initial and late phases of inflammation in rat paw and attenuates the production of eicosanoids in rat neutrophils and human platelets. J. Ethnopharmacol. 2008, 120, 248–254. [CrossRef]
24. Dubois, C.; Abeele, F.V.; Lehen'Kyi, V.; Gkika, D.; Guarmit, B.; Lepage, G.; Slomianny, C.; Borowiec, A.S.; Bidaux, G.; Benahmed, M.; et al. Remodeling of Channel-Forming ORAI Proteins Determines an Oncogenic Switch in Prostate Cancer. Cancer Cell 2014, 26, 19–32. [CrossRef]
25. Stables, M.J.; Gilroy, D.W. Old and new generation lipid mediators in acute inflammation and resolution. Prog. Lipid Res. 2011, 50, 35–51. [CrossRef]
26. Dennis, E.A.; Norris, P.C. Eicosanoid Storm in Infection and Inflammation. Nat. Rev. Immunol. 2015, 15, 511–523. [CrossRef]
27. Benito, P.B.; Lanza, A.M.D.; Sen, A.M.S.; Matellano, L.F.; Gómez, A.S.; Martínez, M.J.A.; Galindez, J.D.S. Effects of Some Iridoids from Plant Origin on Arachidonic Acid Metabolism in Cellular Systems. Planta Med. 2000, 66, 324–328. [CrossRef]
28. Safayhi, H.; Sailer, E.-R. Anti-Inflammatory Actions of Pentacyclic Triterpenes. Planta Med. 1997, 63, 487–493. [CrossRef]
29. Busse, W.W. Leukotrienes and inflammation. Am. J. Respir. Crit. Care Med. 1998, 157, S210–S213. [CrossRef]
30. Schinella, G.; Máñez, S.; Ríos, J.L.; Prieto, J.M.; Giner, R.M.; Recio, M.C. Diphyllin Acetylapioside, A 5-Lipoxygenase Inhibitor from Haplophyllum hispanicum. Planta Med. 2002, 68, 359–360.
31. Cho, J.Y.; Yoo, E.S.; Baik, K.U.; Park, M.H.; Han, B.H. In Vitro Inhibitory Effect of Protopanaxadiol Ginsenosides on Tumor Necrosis Factor (TNF)-α Production and its Modulation by Known TNF-α Antagonists. Planta Med. 2001, 67, 213–218. [CrossRef]
32. Lawrence, T.; Willoughby, D.A.; Gilroy, D.W. Anti-inflammatory lipid mediators and insights into theresolution of inflammation. Nat. Rev. Immunol. 2002, 2, 787–795. [CrossRef]
33. Franceschi, C.; Campisi, J. Chronic Inflammation (Inflammaging) and Its Potential Contribution to Age-Associated Diseases. J. Gerontol. Ser. A Boil. Sci. Med. Sci. 2014, 69, S4–S9. [CrossRef]
34. Larsen, G.L.; Henson, P.M. Mediators of inflammation. Annu. Rev. Immunol. 1983, 1, 335–359. [CrossRef]
35. Hersh, E.M.; Bodey, G.P. Leukocytic Mechanisms in Inflammation. Annu. Rev. Med. 1970, 21, 105–132. [CrossRef]
36. Biswas, S.K. Does the interdependence between oxidative stress and inflammation explain the antioxidant paradox? Oxidative Med. Cell. Longev. 2016, 2016. [CrossRef]
37. Kumar, V.; Abbas, A.K.; Fausto, N.; Aster, J.C. Robbins and Cotran Pathologic Basis of Disease; Elsevier Health Sciences: London, UK, 2014.
38. Anderson, M.T.; Staal, F.; Gitler, C.; Herzenberg, L.A. Separation of oxidant-initiated and redox-regulated steps in the NF-kappa B signal transduction pathway. Proc. Natl. Acad. Sci. USA 1994, 91, 11527–11531. [CrossRef]
39. Flohé, L.; Brigelius-Flohé, R.; Saliou, C.; Traber, M.G.; Packer, L. Redox Regulation of NF-kappa B Activation. Free. Radic. Boil. Med. 1997, 22, 1115–1126. [CrossRef]
40. Heras, B.D.L.; Hortelano, S. Molecular basis of the anti-inflammatory effects of terpenoids. Inflamm. Allergy-Drug Targets 2009, 8, 28–39. [CrossRef]
41. Lee, J.-H.; Choi, J.K.; Noh, M.S.; Hwang, B.Y.; Hong, Y.S.; Lee, J.J. Anti-inflammatory effect of kamebakaurin in vivo animal models. Planta Med. 2004, 70, 526–530. [CrossRef]