



# INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR)

An International Open Access Journal | Approved By ISSN and UGC

UGC Approval Journal No: 43602

Publication Date: 03/06/2019

Published URL: <http://www.ijrar.org/viewfull.php>

Registration ID: IJRAR\_213972

Paper ID: IJRAR2001860

Page No: 63-72

## A REVIEW ON DIFFERENT FORMULATIONS OF PUNICA GRANATUM

*Dr. Syed Ayaz Ali, Mr. Moizul Hasan\**

*Y. B. Chavan College of Pharmacy,*

*Dr. Babasaheb Ambedkar Marathwada University,*

*Aurangabad-431001, Maharashtra, India*

### Abstract:

Plant-based preparations have been used since olden times and playing a role as a curative against different human and animal diseases. The curiosity in conventional medicines has increased in different parts of the world. A well known olden fruit named Punica granatum is commonly known as Pomegranate, Anar or Dalim in North India whose curative qualities have rebounded and echoed throughout the millennia. It contains numerous valuable ingredients such as flavonoids, ellagitannin, punicalagin, ellagic acid, vitamins and minerals. The main constituents including punicalagins and ellagitannin are responsible for beyond measure health benefits due to its strong antioxidant activity. As well, constituents of pomegranate show health-promoting effects through the modulation of physiological and biochemical pathways. Recent evidence suggested that pomegranates fruits, peels and seeds demonstrate therapeutics implications in health management via inhibition of free radical effect and modulation of enzymes activity linked with disease development. In this review, we summarize the work of different researchers on pomegranate in the different formulations for the different diseases.

**Keywords:** Punica granatum, Punicalagin, Novel Drug Delivery System, Pomegranates, dosage form, formulations.

## Introduction

*Punica granatum* (Pomegranate) is a small tree that measures between five and eight meters tall and mainly found in Iran, the Himalayas in northern India, China, the USA and throughout the Mediterranean region. *Punica granatum* (Pg) is one of the important endemic plants of Iran, growing in most regions throughout the country, in arid and semiarid regions due to its ability to adapt to adverse environmental conditions. Over 764 cultivars of *Punica granatum* have been collected during a germplasm collection and grown in the cities of Saveh and Yazd (Iran), all of which possess specific fruit characteristics including size, color, taste, time of ripening, and disease resistance. The Pg can be also divided into several anatomical compartments including seed, juice, peel, leaf, flower, bark, and root with each possessing interesting pharmacological and toxicological activities. The edible fruit is a berry which is about 5-12 cm in diameter with a rounded hexagonal shape, thick reddish skin and around 600 seeds, each surrounded by a water-laden pulp (aril) ranging in color from white to deep red or purple, the aril is the edible part of the fruit. The seeds are embedded in a white, spongy, astringent pulp. According to the holy Quran, pomegranates grow in the gardens of paradise and the Quran has recited the Pg twice as an example of god's good creations.

The fruit of the Pg has extensively been used as a traditional remedy against acidosis, dysentery, microbial infections, diarrhea, helminth infection, hemorrhage, and respiratory pathologies. Pg seeds have also been shown to contain estrogenic compounds, estrone, and estradiol. Furthermore, the dried pericarp and the juice of the fruit are considered beneficial for the treatment of colic, colitis, menorrhagia, oxyuriasis, headache, diuretic, acne, piles, allergic dermatitis, and treatment of oral diseases. Recent studies have shown new scientific investigations for the traditional uses of Pg.

### Different formulations of *Punica granatum*

#### Nanoparticles

##### **“Mucoadhesive polyethyleneimine–dextran sulfate nanoparticles containing *Punica granatum* peel extract as a novel sustained-release antimicrobial”**

Mucoadhesive polyethyleneimine–dextran sulfate nanoparticles (PDNPs) were developed for local oral mucosa delivery. *Punica granatum* peel extract (PGE) was loaded into PDNPs for oral malodor reduction and caries prevention. PDNPs were constructed using the polyelectrolyte complexation technique employing oppositely charged polymers polyethyleneimine (PEI) and dextran sulfate (DS), with PEG 400 as a stabilizer. Under optimal conditions, spherical particles of 500nm with a zeta potential of +28mV were produced. Up to 98%, drug entrapment efficiency was observed. The mass ratio of PEI: DS played a significant role in controlling the particle size and entrapment efficacy. PDNPs are shown to be a good mucoadhesive drug delivery system as confirmed by *ex vivo wash off test*. In vitro dissolution studies revealed that PGE-loaded PDNPs manifested a prolong release characteristic with a burst release within 5 min. Also, they remained effective against oral bacteria. (Waree Tiyaboonchai et al. 2014)

#### Niosomes

##### **“Formulation and Evaluation of Niosomes Containing Punicalagin from Peels of *Punica Granatum*”**

The objective of the present study is to develop and validate a simple, precise, accurate, and economical analytical method for the estimation of Punicalagin extracted from peels of *Punica granatum*. To perform the compatibility study of drug, Punicalagin with the excipients used in formulating niosomes. To develop a vesicular system like niosomes that act as carriers and hence will help in penetration of drug through the skin and provide a prolonged release. Punicalagin is chemically named as 2, 3-(S)-hexahydroxydiphenoyl-4,6-(S, S)-gallagyl-D-glucose and belongs to a category of hydrolyzable tannin. Thus, to protect its hydrolysis, it is formulated into a nanocarrier system known as niosomes which is based on the preparation of niosomes by using a non-ionic surfactant in varying amounts and keeping the amount of cholesterol constant. The formulations were evaluated based on evaluation parameters and thus optimized for the best formulation. ( Priya Hanu and Singh Harmanpreet, 2012 )

## Hydrogel

### “*Punica granatum* L. Hydrogel for Wound Care Treatment: From Case Study to Phytomedicine Standardization”

The pharmacological activities of many *Punica granatum* L. components suggest a wide range of clinical applications for the prevention and treatment of diseases where chronic inflammation is believed to play an essential etiologic role. The current work reports a case study analyzing the effect produced by a magistral formulation of ethanolic extracts of *Punica granatum* peels on a non-healing chronic ulcer. The complete closure of the chronic ulcer that was initially not responsive to standard medical care was observed. A 2% (w/w) *P. granatum* peels ethanolic extract hydrogel-based formulation (PGHF) was standardized and subjected to physicochemical studies to establish the quality control parameters using, among others, assessment criteria such as optimum appearance, pH range, viscosity, and hydrogel disintegration. The stability and quantitative chromatographic data were assessed in storage for six months under two temperature regimes. An efficient HPLC-DAD (Diode Array Detector) method was established distinguishing the biomarkers punicalin and punicalagin simultaneously in a single 8 min run. PGHF presented suitable sensorial and physicochemical performance, showing that punicalagin was not significantly affected by storage ( $p > 0.05$ ). Formulations containing extracts with not less than 0.49% (w/w) total punicalagin might find good use in wound healing therapy. (Aline Fleck et al. 2016)

## Microemulsion

### “Topical microemulsion containing *Punica granatum* extract: its control over skin erythema and melanin in healthy Asian subjects”

To explore a topical microemulsion (O/W) of pomegranate (*Punica granatum*) extract for its control on skin erythema and melanin. *Punica granatum* is a potent source of polyphenolic compounds with strong free radicals scavenging activity. The skin lightening effects of *Punica granatum* are assumed due to ellagic acid which acts by chelating copper at the active site of tyrosinase. Microemulsions were formulated using a polysorbate surfactant (Tween 80) along with cosurfactant (propylene glycol) and were characterized regarding their stability. The placebo microemulsion (without extract) and the active microemulsion (containing *Punica* extract) were applied in a split face fashion by the volunteers ( $n = 11$ ) for 12 weeks. Skin erythema and melanin were measured at baseline and after every 15 days to determine any effect produced by these formulations. The active formulation showed a significant impact on skin erythema and melanin ( $p < 0.05$ ). This study reveals that a suitable topical formulation like microemulsion could employ the *Punica granatum* extract for conditions where elevated skin melanin and erythema have significantly prone skin physiology. (Rashida Parveen et al. 2014)

## Microparticles

### “Therapeutic potential of biodegradable microparticles containing *Punica granatum* L. (pomegranate) in the murine model of asthma”

Among the options for treatment of diseases affecting the respiratory system, especially asthma, drug-delivering systems for intranasal application represent an important therapeutic approach at the site of inflammation. The present study aimed to evaluate the therapeutic effect of biodegradable microparticles formed by polylactic-co-glycolic acid (PLGA) containing encapsulated pomegranate extract on a murine model of asthma. The extract was acquired from the leaves of *P. granatum* and characterized qualitatively by HPLC. A w/o/w emulsion solvent extraction–evaporation method was chosen to prepare the microparticles containing pomegranate encapsulated extract (MP). OVA-sensitized (Chicken ovalbumin) BALB/c mice were used as an asthma model and treated with dexamethasone and *P. granatum* extracts in solution form or encapsulated into microparticles. MP was able to inhibit leukocytes' recruitment to bronchoalveolar fluid, especially, eosinophils, decreasing cytokines (IL-1b and IL-5) and protein levels in the lungs. This approach can be used as an alternative/ supplementary therapy based on the biological effects of *P. granatum* for managing inflammatory processes, especially those with pulmonary complications. (Jessica F. F. de Oliveira et al. 2013)

## Mouthwash

### “A comparative evaluation of the efficacy of Punica granatum and chlorhexidine on plaque and gingivitis”

The present work aimed to investigate the possible efficacy of hydroalcoholic extract from *Punica granatum* fruit mouthwash as an anti-plaque and anti-gingivitis agent when compared with chlorhexidine. The hydroalcoholic extract was prepared from whole fresh fruits (4-5 fruits) that were cut into small pieces and blended with a mixture of ethanol and distilled water (1:1, v/v). The material was filtered through several layers of gauze and evaporated at 60°C to one-third of its original volume or until all the ethanol evaporated. The volume was restored with distilled water, and 1 ml sample was completely evaporated in the oven, to get the insoluble residues/ml (used to express the final hydroalcoholic concentration, which ranged between 50 and 60 mg/ml), which was further used to adjust the concentration of mouthwash. The clinical study observed significant improvement in gingival status in both the sites ( $P < 0.05$ ). Subjects using *Punica granatum* mouthwash showed significant improvement in bleeding and gingivitis score as compared with chlorhexidine. In contrast, *Punica granatum* was shown not to be so effective in reducing plaque scores. Chlorhexidine remains as a standard in the reduction of plaque in subjects with gingivitis. *Punica granatum* mouthwash is beneficial in improving gingival status due to its profound styptic action, with a sufficient reduction in plaque scores. (Sakshi Ahuja et al. 2011)

### “Assessing the effect of pomegranate fruit seed extract mouthwash on dental plaque and gingival inflammation”

Utilizing natural products in the prevention and treatment of periodontal diseases has been increased recently and could be of benefit to low socioeconomic level communities. Mouthwashes are very useful in the reduction of microbial plaque and gingival inflammation. Pomegranate (*Punica granatum*) is an essential medicinal plant with various pharmacological properties. In this study, the efficacy of a mouthwash prepared from the extract of pomegranate fresh fruit, was evaluated in the reduction of dental plaque and gingival bleeding. One hundred and four participants diagnosed as mild to moderate gingivitis participated in this double-blind clinical trial. Two weeks after thorough scaling and root planing, the participants were randomly and equally divided into four groups: group 1 - Persica, Group 2 - Matrica, Group 3 - pomegranate mouthwashes and Group 4 - placebo. The participants were instructed to use the prescribed mouthwashes, twice daily, for 1 month. Pomegranate mouthwash was prepared from seeds of the fresh pomegranate fruit. Periodontal parameters including plaque and bleeding indices were assessed at baseline (2 weeks after Phase I of treatment) and 1 month after using mouthwashes. A comparison of the plaque index showed a significant reduction from baseline to 1 month in all groups ( $P < 0.05$ ). However, there was no significant difference in the reduction of plaque when comparing four groups. Assessment of the bleeding on probing revealed a significant decrease from baseline to 1 month in all groups ( $P < 0.05$ ). The three herbal mouthwashes reduced the bleeding index significantly more than the placebo ( $P < 0.05$ ). Pomegranate mouthwash was beneficial in improving gingival status, including reducing plaque and bleeding indices. Its effect was comparable to two routinely used herbal mouthwashes. (Farin Kiany et al. 2016)

### “In vivo antimicrobial inhibition of Punica granatum extracts as mouthwash”

An objective of this study is to determine the effect of *Punica granatum* (pomegranate) extract on microbial activity of some bacterial genus isolated from the mouth. Complex polysaccharides have been detected and characterized in *Punica granatum* or pomegranate constituents who may act as a fungal and bacterial inhibitor as well as an anti-inflammatory effect. However, limited studies were reported using pomegranate extracts as an antibacterial mouthwash. This study included the preparation of three different concentrations of *Punica granatum* methanolic extract of 25%, 50%, and 75%. The inhibition activity of these extracts was tested on different strains such as Sm, Sa, Ec, Kp, Sg, and Sf. Results exhibited an effective inhibition of pomegranate extracts against most of the tested strains which were isolated from patients' mouths. The 50% and 75% concentrations of methanolic extract exhibited significant inhibition against four tested strains compared to mouthwash ( $P \leq 0.05$ ), while the 25% concentration was less effective than the other concentrations and its antibacterial effect was non-significant in comparison with the mouthwash. This study indicates the inhibitory effects of *Punica granatum* extracts of high percentage on microbial activity of some bacterial genus isolated from patients' mouths and suggests the possibility to prepare a mouthwash from pomegranate extract. ( Dhifaf M. Al-Obaidi et al. 2017)



## Gel

### “Antibacterial Potential herbal formulation”

Natural drugs are boon to mankind. They have few side effects as compared to allopathic medicine. This invention relates to an herbal composition, having potent anti-bacterial and wound healing properties. The formulation prepared is a gel, which is used for effective treatment of wounds and exhibits broad-spectrum antibacterial action. Crude extracts of Punica granatum pericarp and Curcuma longa showed antibacterial activity against different strains of gram-positive such as Staphylococcus aureus, Bacillus subtilis and gram-negative microorganisms such as Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Proteus Vulgaris and Enterobacter aerogenes. The MIC is recorded as the lowest concentration of drug which showed clear fluid without turbidity. Minimum inhibitory concentration of Punica granatum peel ranged from 0.05 to 3.2 mg/mL and Curcuma longa MIC ranged from 5 to 320 mcg/mL. A formulation containing these extracts, showed a significant zone of inhibition for 0.5, 1, 2.5, 5% of which 5% showed maximum zone of inhibition (ranging from 20.2 to 26 mm) as compared to marketed preparation. The present investigation revealed that gel formulation has potential antibacterial activity. (Archana A. Bele, et al. 2009)

### “Antibacterial Inhibitory Effects of Punica Granatum Gel on Cariogenic Bacteria: An in vitro Study”

This study evaluated the in vitro antibacterial effects of the formulated Punica granatum (PG) gel against Streptococcus mutans, Streptococcus sanguinis, and Lactobacillus casei. The PG extract was dissolved in water at 500 mg/mL. High-performance liquid chromatography (HPLC) was used for the identification and quantification of chemical marker punicalagin. Minimum bactericidal concentration (MBC) and time-kill assay (TKA) were investigated. Antibacterial activities of the formulated PG gel, 2% chlorhexidine (CHX) gel and blank gel were tested by measuring the zones of inhibition through agar well diffusion method. The HPLC results showed the presence of punicalagin at  $2023.58 \pm 25.29$   $\mu\text{g/mL}$  in the aqueous PG extract and at 0.234% (w/w) in the formulated PG gel. The MBC for S. mutans, S. Sanguinis, and L. casei were 250, 125, and 500 mg/mL respectively. The TKA of 500 mg/mL aqueous PG extract showed total inhibition of S. mutans, S. Sanguinis, and L. casei at 6, 1, and 24 hours contact time respectively. Agar well diffusion revealed that for S. mutans, CHX gel > PG gel > blank gel; for S. sanguinis, CHX gel = PG gel > blank gel; for L. casei, CHX gel > PG gel = blank gel. Comparison of the PG gel potency showed that S. sanguinis = S. mutans > L. casei. The PG gel equivalent to 0.234% punicalagin (w/w) inhibited S. mutans and S. sanguinis but not L. casei within 24 hours' incubation period and has the potential to be used for caries prevention. (Grazielle Millo, et al. 2017)

### “Design, Formulation, and Evaluation of an Oral Gel from Punica Granatum Flower Extract for the Treatment of Recurrent Aphthous Stomatitis”

Recurrent aphthous stomatitis is a disease with unknown etiology that's mostly treated symptomatically and has no definite cure. Pomegranate (Punica granatum) flowers have been used as a medicinal herb that due to its antimicrobial, antioxidant, anti-inflammatory, analgesic and healing effects, has been useful in the treatment of oral aphthous. Therefore, we decided to formulate a mucoadhesive gel with pomegranate flower extract to reduce the need for corticosteroid therapy in patients. Pomegranate flowers are extracted by percolation method. Several formulations with different amounts of carbomer 934, sodium carboxymethylcellulose (SCMC) and hydroxypropyl methylcellulose K4M were prepared and the condensed extract was dispersed in polyethyleneglycol (PEG) 400 and added to gel bases. Then the formulations underwent macroscopic and microscopic studies. The formulations that passed these tests successfully were studied through assay tests using spectrophotometry in 765 nm, drug release from the mucoadhesive gel using cell diffusion method, viscosity test, mucoadhesion test, and accelerated stability test. The phenolic content of pomegranate flower dried extract was found to be  $212.3 \pm 1.4$  mg/g in the dried extract. The F4–F6 formulations contain carbomer 934, SCMC, pomegranate flower extract, PEG 400, potassium sorbate and purified water passed all above tests. The F4 formulation had higher viscosity and mucoadhesion values due to its higher carbomer 934 and SCMC content. Since F4, F5 and F6 had no significant variation in drug release, the F4 formulation was chosen as the superior formulation because of proper appearance and uniformity, acceptable viscosity, mucoadhesion and stability in different temperatures. (Abolfazl Aslani et al 2016)

### “Formulation and Evaluation of Punica Topical Gel for its Content of Gallic Acid and Antimicrobial Study”

Dried, powdered peel of *Punica granatum* was extracted with aqueous as solvent using soxhlet. Topical formulation gels were formulated with a different combination of polymers and aqueous extract of Punica. These formulations were evaluated for their physicochemical parameters, viscosity, spreadability, gallic acid content (by HPLC) and antimicrobial activity. The gel was successfully formulated and evaluated for the pharmaceutical parameters of the formulation and also for the content of gallic acid (3.5%). The gel gave very well antibacterial and antifungal activity. (Tejaswi Chalke et al. 2016)

### “Formulation, characterization, and determination of the antibacterial activity of Pomegranate (*Punica Granatum*) gel”

Previous studies have shown that *Punica granatum* (*P. granatum*) extract exhibited antimicrobial activity against a wide range of pathogenic microorganisms. Thus, a study aimed to formulate and determine the effectiveness of antimicrobial properties of gel containing *P. granatum* methanol extract against selected common skin pathogens including *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, and *Candida albicans*. The extraction process utilizes *P. granatum* peel and methanol as solvent. Using the disc diffusion method, different concentrations (25 % w/v, 50 % w/v, 75 % w/v and 100 % w/v) of *P. granatum* extract were initially tested against *S. aureus*, *S. epidermidis*, *P. aeruginosa* and *C. Albicans* for their antibacterial activity. Gel formulations were then prepared with varying concentrations of the extract as an active ingredient. The antimicrobial activity of *P. granatum* gel was determined by using the agar well diffusion method. The gel formulations were stored at 4°C, 25°C and 37°C for one month. Evaluation of the pH, physical characteristics and antimicrobial activity were then conducted on the gel formulations. Both extract and gel showed the highest antibacterial activity against *S. epidermidis* followed by *S. aureus* and then *P. aeruginosa*. Surprisingly no antifungal activity was observed against *C. Albicans*. The concentrations of extract alone and in the gel were directly proportional to antibacterial activity. All gels formulated showed satisfactory physical characteristics even after a month of storage at different temperatures. As expected, gel stored at 4°C showed the least decrease in antibacterial activity. *P. granatum* has the potential to be formulated as a gel to treat bacterial skin infection caused by *S. aureus*, *S. epidermidis*, and *P. aeruginosa*. Further studies are required to optimize the antimicrobial activity of *P. granatum* gel. (Afendi Dahlan and Mohd Asyraf Mohd Razali, 2015)

### Cream

### “Determination of active phytochemicals from formulated sunscreen cream containing *Pongamia Pinnata* leaves and *Punica Granatum* peel extract by high-performance thin-layer chromatography”

The present investigation has been focused on the determination of the photoprotective activity of the 10% formulated sunscreen cream containing *Pongamia pinnata* and *Punica granatum* extract (3:2) in combination. And the quantitative estimation of phytoconstituents from both the extracts and in the formulated Sunscreen cream by the High-Performance Thin Layer Chromatography (HPTLC) method. Formulated Sunscreen cream was evaluated for Sunscreen activity. It is reported that Ellagic acid (polyphenol) and Karanjin (flavonoid) are responsible for the Sunscreen activity of *Punica granatum* and *Pongamia pinnata* respectively. Therefore, Ellagic acid was used as a standard marker for *Punica granatum* and Karanjin was a Standard marker for *Pongamia pinata*. Ellagic acid and karanjin were chromatographed on TLC aluminum sheets silica gel plates using Chloroform: methanol: formic acid (9:1:2 v/v/v) and Toluene: ethyl acetate (7:3 v/v) as Mobile phase respectively. Detection and Quantification of both the extracts as well as formulated sunscreen cream were performed at Lambda 273 nm. The formulated Sunscreen cream has shown good Photoprotective activity. The RF values of standards were 0.23 for Ellagic acid and 0.6 for Karanjin. The total peak areas of the standards and the corresponding peak areas of extracts were composed and the statistical analysis was carried out. From the present findings, it was concluded that there is a presence of Ellagic acid and Karanjin in *Punica granatum* and *Pongamia pinnata* respectively. As well as both the standards are present in 10% formulated Sunscreen cream in good quantity indicates the Photo-protective effect of the formulation. (Sneha Patil et al. 2015)

## **“Formulation and Evaluation of Herbal Vanishing Cream Containing Punica Granatum”**

Everyone needs natural and beautiful skin so that natural skincare products are growing day by day in the present market. The main objective of these natural products is to avoid skin problems and to protect the skin from harmful chemicals and also to give healthy skin. By extracting the seeds and peel of Punica granatum (Pomegranate) with olive oil and almond oil the herbal vanishing creams of 4 formulations were formulated named C1, C2, C3, and C4. The prepared formulations were evaluated for physical evaluation tests like color, odor and evaluated for different evaluation parameters like pH, homogeneity, viscosity, type of smear, after-feel test, dye test, spreadability test, patch test, and skin irritation studies were done on rat skin. The results were found good and no erythema and hypersensitivity were found on rat skin therefore the formulated creams were tested on human skin and found satisfactory. All the 4 formulations were subjected to accelerated stability studies for 20 days by maintaining at different temperatures and creams were evaluated for different parameters and there was no change in the results. (D. Nirmala kumara, et al. 2016)

## **Emulsion**

### **“Development of Skin-friendly Dermatological Water-in-Oil Emulsion of Pomegranate Juice”**

This study was designed to develop a topical skin-care cream (w/o emulsion) of 4% pomegranate extracts versus its vehicle (the base) as control and evaluate its effects on skin-melanin, skin erythema, skin moisture, skin sebum and TEWL (skin sebum and transepidermal water loss). Concentrated pomegranate (Punica granatum) juice was entrapped in the inner aqueous phase of w/o emulsion. The base containing no extract and a formulation containing 4% concentrated juice of pomegranate was formulated. The odor was adjusted with a few drops of lemon oil. Both the base and the formulation were stored at different storage conditions for four weeks to predict their stability. The stability parameters, i.e., physical stability, centrifugation and pH, were monitored at different time intervals. Both the base and the formulation were applied to the cheeks of 25 healthy human volunteers for 8 weeks. The pharmaceutical stability of creams was achieved from 4 weeks in-vitro study period. Odor disappeared with time due to the volatilization of lemon oil. The formulation exhibited a significant effect on skin melanin and skin erythema. Both the vehicle (base) and the formulation tended to increase sebum content. The results showed good stability over 4 weeks in-vitro observation period of both the base and the formulation and the formulation exhibited bleaching, anti-inflammatory and moisturizing effects. Both the vehicle (base) and the formulation were elegant and aesthetic concerning sensory evaluation. (Naveed Akhtar et al. 2012)

## **Semisolid Emulsified Systems**

### **“Extract of Punica Granatum L: An alternative to BHT as an antioxidant in semisolid emulsified systems”**

Pomegranate (Punica granatum L.) is a fruit that has important pharmacological activities and has been attracting attention due to its important antioxidant activity, a significant feature of cosmetics. Formulations containing different concentrations of an ethanolic extract of pomegranate (0.1, 1.0 and 5.0%) (w/w) as an antioxidant agent showed that this is an interesting alternative for the use of natural products with biological activity. The stability and rheology of semisolid systems containing an extract of this plant were evaluated. Preliminary stability studies showed greater Physico-chemical stability of the formulation, and thus it was used in an accelerated stability study, as well the quantification of total phenolic compounds and the determination of antioxidant activity. It was observed that different concentrations of the extract did not significantly influence the stability. Moreover, the formulation was found to have better stability when stored at room temperature than under heated or cooling conditions. Formulations containing 0.1 and 5.0% of the extract showed more stable rheological behavior, due to the absence of a solid/liquid transition in the rheogram. Tests confirmed the high phenolic content and antioxidant activity, demonstrating the potential of this plant for use in cosmetology as an antioxidant. ( Jessica Tiago Tozetto. Et al. 2017)

## Ointment

### “In Vivo, Topical Wound Healing Activity of Punica Granatum Peel Extract on Rats”

Punica granatum is a well-known fruit for its antioxidant, hepatoprotective, anticancer, antibacterial potential. The methanolic extract of Punica granatum, in the form of an ointment with two different concentrations (10% and 15% w/w ointment of extract in simple ointment base) was evaluated for wound healing potential in an excision wound model in rats. The results were comparable to standard drug Nitrofurazone ointment. It was observed that the wound contracting abilities of 10% and 15% extract ointments (97.8%, 98.4%) were significantly ( $P < 0.05$ ) greater than that of the control. The wound closure time was less and the percentage of wound contraction was much more with the 15% w/w extract ointment treated group. On 18th day 100% contraction was observed which was almost similar to that of the nitrofurazone ointment group. 10% w/w extract ointment group of animals showed significant wound contraction from the 18th day onwards and achieved 100% with the wound closure time of 20th days. Both concentrations of the methanolic extract of Punica granatum ointment showed significant responses when compared with the control group. Thus methanolic extract of Punica granatum proves to be a potential wound healing agent. (Nitin Nema. Et al. 2013)

## Probiotic Pomegranate Juice

### “Fermentative preparation of functional drink from Punica granatum using lactic acid bacteria and exploring its anti-tumor potential”

In the present research work probiotic pomegranate juice production by fermentation was carried out using two different strains such as Lactobacillus Plantarum VITES07 and Lactobacillus acidophilus NCIM2903 (Lactic acid bacteria). Fermented pomegranate juice was carried out at room temperature for 72h. During the fermentation period at regular intervals viable cells were determined. The efficiency of the fermented juice was analyzed for 4 weeks under the refrigerated condition at 4°C. Total phenolics, sugar concentration, antioxidant potential, and antibacterial activity were determined. The organic acid concentration was determined by HPLC with the retention time of a compound at 9.1 can be suspected to be Kaempferol hexoside and the functional group was determined by FTIR also LCMS analysis was carried out to enumerate the chemical composition of the fermented juice. (Shruthi N Murthy. Et al.2017)

## Medicinal Soap

### “Preparation of Medicinal Soap Products Using the Leaf Extracts of Punica Granatum (Pomegranate)”

The present study was carried out to prepare medicinal soaps with antibacterial and/or antioxidant activities using leaf extracts of pomegranate. Leaf extracts of pomegranate were obtained by maceration, soxhlet extraction and sonication using a series of solvents. The extracts were screened for antibacterial activity using the disk diffusion assay carried out against B.cereus, S.typhimurium, S.aureus and E.coli. The Folin Cioclteau (FC) and DPPH radical scavenging assays were used to determine the total antioxidant capacity (AOC) and the DPPH radical scavenging activity (RSA) respectively. The presence of phytochemical constituents of bioactive extracts was investigated. Bioactive leaf extracts were used to prepare a liquid and a solid soap and their effectiveness were determined. Methanol soxhlet extract was the best bioactive extract exhibiting considerable antibacterial activity against S.aureus and B.cereus and the highest total AOC of 603 µg PGE/mg. It displayed a 94% RSA as well. Therefore, this extract was used in liquid and solid soap preparations. The liquid soap inhibited the growth of S.aureus and B.cereus at 25 mg/mL and 10 mg/mL concentrations respectively. A thumb impression test indicated a reduction of the microbial growth upon the usage of the medicinal soap displaying its antibacterial effectiveness. The liquid soap displayed 6.7 times better AOC whereas the solid soap indicated 2.5 times better AOC compared to their control soaps. The solid soap did not display any significant antibacterial activity even at a 100 mg/mL concentration. Leaf extracts of the pomegranate can be successfully utilized to obtain medicinal soaps with improved antibacterial and antioxidant activities. (Wijetunge W.M.A.N.K and Perera B.G.K, 2016)



## Herbal Lipstick

### “Formulation and Evaluation of a Herbal Lipstick from Punica granatum Fruit Peel”

The use of herbs in cosmetic applications has increased exponentially during recent years. The objective of the present study involves the preparation and evaluation of herbal lipstick containing different formulations of Punica granatum peel extracts (F1, F2, F3, F4, and F5). Evaluation parameters such as melting point, breaking point, thixotropy character, the force of application and surface anomalies were performed. The results showed that formulation F4 containing Punica granatum peel extract has better stability than other formulations. (A. Elumalai. Et al. 2012)

## Beef Meatballs

### “Formulation of Value Added Beef Meatballs with Pomegranate (Punica granatum) Extract as a Source of Natural Antioxidant”

The experiment was conducted to find out the effect of different levels of pomegranate extract and synthetic antioxidant (Beta Hydroxy Anisole). Pomegranate extract at 0.1%, 0.2%, 0.3% was examined on fresh and preserved beef meatballs for 60 days' storage period and evaluated for proximate, sensory, physicochemical, biochemical and microbiological quality. The experiment was conducted by a factorial experiment in a completely randomized design. CP, EE, raw and cooked pH value, sensory traits were increased significantly ( $p < 0.05$ ) and DM, Ash, FFA, POV, TBARS, TVC, TCC, TYMC were decreased significantly ( $p < 0.05$ ) in all treatments. Conversely, all sensory traits, CP, raw and cooked pH, cooking loss, TCC, and TYMC were decreased significantly ( $p < 0.05$ ) at different days of intervals. Hence, considering the sensory evaluation, nutrient quality, physicochemical properties, biochemical and microbial analysis 0.3% pomegranate extract can be recommended for a formulation of value-added beef meatball enriched with natural antioxidants. (Israt Jahana. Et al. 2018)

## Conclusion:

Medicinal potential of Punica Granatum is colossal and hard to cover in a single article, despite this current article provided glimpses of Punica Granatum Formulations for performing an appraisal of this promising nutrition and medicinal plant. Although many bioactive compounds have been discovered from Punica Granatum, still the knowledge is in the early years, in terms of its total reserve. Thus, phytochemical and analytical studies may lead to the development of novel drug delivery systems and bioactive medicines for various disorders.

## Acknowledgment:

I am very grateful to Y. B. Chavan College of Pharmacy, Aurangabad and my supervisor for providing me huge support and unrestricted literature survey to facilitate the preparation of this review on Punica Granatum.

## References:

- 1) Waree Tiyaboonchai, Ingdao Rodleang, and Anan Ounaron, “Mucoadhesive polyethylenimine–dextran sulfate nanoparticles containing Punica granatum peel extract as a novel sustained-release antimicrobial”, Pharm Dev Technol, Informa Healthcare USA, Published online on 17 Jan 2014.
- 2) Priya Hanu, Singh Harmanpreet, “Formulation and Evaluation of Niosomes Containing Punicalagin from Peels of Punica Granatum” Journal of Drug Delivery & Therapeutics, 2(6), 56-67, 2012.
- 3) Aline Fleck, Patrik F. G. Cabral, Felipe F. M. Vieira, Deo A. Pinheiro, Carlos R. Pereira, Wilson C. Santos and Thelma B. Machado, “Punica granatum L. Hydrogel for Wound Care Treatment: From Case Study to Phytomedicine Standardization”, Molecules, 21,1059, 2016.
- 4) Rashida Parveen, Naveed Akhtar, and Tariq Mahmood, “Topical microemulsion containing Punica granatum extract: its control over skin erythema and melanin in healthy Asian subjects Postep Derm Alergol, XXXI, 6, 351–355, 2014.
- 5) Jessica F. F. de Oliveira, Diego V. Garreto, Mayara C. P. da Silva, Thiare S. Fortes • Rejane B. de Oliveira, Fla´via R. F. Nascimento, Fernando B. Da Costa, Marcos A. G. Grisotto, Roberto Nicolete, “Therapeutic potential

- of biodegradable microparticles containing *Punica granatum* L. (pomegranate) in a murine model of asthma” *Inflammation Research*, 62, 971–980 Published online: 25 Aug 2013.
- 6) Sakshi Ahuja, Vidya Dodwad, Bhavna Jha Kukreja, Praful Mehra, Pankaj Kukreja “A comparative evaluation of the efficacy of *Punica granatum* and chlorhexidine on plaque and gingivitis”, *Journal of the International Clinical Dental Research Organization*, January-April 2011, Vol-3, Issue 1.
  - 7) Farin Kiany, Hossein Niknahad, Mohammad Niknahad, “Assessing the effect of pomegranate fruit seed extract mouthwash on dental plaque and gingival inflammation” *Journal of Dental Research and Review*, Vol-3, Issue 4, Oct-Dec 2016.
  - 8) Dhifaf M. Al-Obaidi, Saja A. Muhsin, Afnan A. Ibrahim, “In vivo antimicrobial inhibition of *Punica granatum* extracts as mouthwash”, *Russian Open Medical Journal* Vol-6, Issue 4, Pg 1-5, 2017.
  - 9) Archana A. Bele, Varsha M. Jadhav, S. R. Nikam and Vilasrao J. Kadam “Antibacterial Potential herbal formulation”, *Research Journal of Microbiology*, 4(4): 164-167, 2009.
  - 10) Grazielle Millo, Apa Juntavee, Ariya Ratanathongkam, Natsajee Nualkaew, Jomjai Peerapattana, Supaporn Chatchiwattana, “Antibacterial Inhibitory Effects of *Punica Granatum* Gel on Cariogenic Bacteria: An in vitro study”, *International Journal of Clinical Pediatric Dentistry*, April-June 2017;10(2):152-157.
  - 11) Abolfazl Aslani, Behzad Zolfaghari, Fatemeh Davoodvandi, “Design, Formulation, and Evaluation of an Oral Gel from *Punica Granatum* Flower Extract for the Treatment of Recurrent Aphthous Stomatitis” *Adv Pharm Bull*, 6(3), 391-398, 2016.
  - 12) Tejaswi Chalke, Krishna Sharma, S. K. Nagare, S. S. Jirge, “Formulation and Evaluation of *Punica* Topical Gel for its Content of Gallic Acid and Antimicrobial Study” *International Journal of Drug Delivery Technology*, 6(3); 75-78, 2016.
  - 13) Afendi Dahlan and Mohd Asyraf Mohd Razali, “Formulation, characterization, and determination of the antibacterial activity of Pomegranate (*Punica Granatum*) gel, *Journal of Applied Pharmacy J App Pharm* Vol. 7; Issue 1: 13-25; January 2015
  - 14) Sneha Patil, Bharti Fegade, Urvashi Zamindar and V.H. Bhaskar, “Determination of active phytochemicals from formulated sunscreen cream containing *Pongamia Pinnata* leaves and *Punica Granatum* peel extract by high-performance thin-layer chromatography” *World Journal of Pharmaceutical Research*, Vol 4, Issue 7, 802-812.
  - 15) D. Nirmala Kumari, Dr. T. Satyanarayana, CH. Sai Kumar, SK. Moulabi, B. Pullarao, A. Gavamma, K. Nagamani, “Formulation and Evaluation of Herbal Vanishing Cream Containing *Punica Granatum*” *Indo American Journal of Pharmaceutical Research*, Vol-6, Issue 03, 2016.
  - 16) Naveed Akhtar, Rashida Parveen, Barkat Ali Khan, Muhammad Jamshaid and Haroon Khan, “Development of Skin-friendly Dermatological Water-in-Oil Emulsion of Pomegranate Juice” *PAOS*, 49 (4): 269–278 (2012)
  - 17) Jessica Tiago Tozetto, Andressa Tiago Tozetto, Bernardo Teixeira Hoshino, Carla Regina Andrighetta, Elton Brito Ribeiro, Larissa Cavalheiro and Stela Regina Ferrarina, “Extract of *Punica Granatum* L: An alternative to BHT as an antioxidant in semisolid emulsified systems” *Quim. Nova*, Vol. 40, No. 1, 97-104, 2017.
  - 18) Nitin Nema, Saurabh Arjariya, S. M. Bairagi, Megha Jha, MD. Kharya, “In Vivo, Topical Wound Healing Activity of *Punica Granatum* Peel Extract on Rats”, *American Journal of Phytomedicine and Clinical Therapeutics*, Vol-1, Issue-2, Pg 195-200, 2013.
  - 19) Shruthi N Murthy, Amie Patnaik, Nandini Srinivasan, E Selvarajan, Nivetha A and Mohanasrinivasan V, “Fermentative preparation of functional drink from *Punica granatum* using lactic acid bacteria and exploring its anti-tumor potential” *Materials Science and Engineering* 263, 022045, (2017).
  - 20) Wijetunge W.M.A.N.K and Perera B.G.K, “Preparation of Medicinal Soap Products Using the Leaf Extracts of *Punica Granatum* (Pomegranate)”, *International Journal of Pharmacy and Biological Sciences*, Vol-6, Issue 2, 07-16, Apr-Jun 2016.
  - 21) A. Elumalai, M. Chinna Eswaraiyah, and M. Nikhitha, “Formulation and Evaluation of an Herbal Lipstick from *Punica granatum* Fruit Peel”, *Research Journal of Topical and Cosmetic Sciences* Vol-3, Issue-1, 2012.
  - 22) Israt Jahana, Md Akramul Haquea, Md. Abul Hashema\*, Farhana Jasmin Rimaa, Shajeda Akhtera, Md Anwar Hossaina, “Formulation of Value Added Beef Meatballs with Pomegranate (*Punica granatum*) Extract as a Source of Natural Antioxidant” *Journal of Meat Science and Technology*, Vol 6, Issue 1, Pages 12-18, January-March, 2018.