NATIONAL SEMINAR

Herbal Medicines as a Foundation for Drug Discovery: Present Status and Future Perspective

24th March, 2018

ABSTRACT BOOK

Organized by

Smriti College of Pharmaceutical Education, Indore

Formulating Confidence for Success

MR-11, Indore-452010 (M.P.)

M. 7898794433 | T. 0731-6952457 | E. principal@scopeindore.info

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Comparative Study and Pharmacological Evaluation of Antiulcer Activity of Some Polyherbal Formulations

Sachin Kumar Jain, Dinesh Kumar Jain, Neelam Balekar

Department of Pharmacology, IPS Academy College of Pharmacy, Rajendra Nagar Indore, Madhya Pradesh, India

Abstract

The present study was aimed at evaluating the antiulcer activity of the polyherbal formulation (PHF) containing the fruit extracts of *Emblica officinalis*, *Terminalia chebula*, and leaf extracts of *Murraya koenigii* in rats. The antiulcer activity of the PHF was evaluated using different models of gastric ulcers: Ethanol-induced and pylorus ligation-induced gastric ulcers. Effectiveness was assessed by determining the ulcer index, gastric juice volume, and gastric juice pH. Administration of the PHF (150 mg/kg, p.o.) offered noteworthy protection against ethanol-induced, pylorus ligation-induced gastric ulcers models when compared to the control group. PHF, containing leaf extracts of *E. officinalis*, *T. chebula*, and leaf extracts of *M. koenigii*, was found to possess antiulcer properties in two experimental animal models of gastric ulcers, and these findings suggest that the significant gastroprotective activity could be mediated by its antioxidant activity.

Key words: Antiulcer activity, pylorus ligation, ulcer index

INTRODUCTION

Man has used plants as medicines for thousands of years.[1] Conventionally, peptic ulcers have been described as difference between luminal acid peptic attacks and mucosal defense.[2] The behavior of peptic ulcers with plant products used in folk medication and fortification of induced gastric ulcer in laboratory animals using medicinal plants was reported. In general, plant flavonoids have been found to be efficient against ulcer in experimental animals and exhibit several biological effects.[3] An ulcer is fundamentally an inflamed break in the skin or the mucus membrane inside layer the alimentary tract. Ulceration occurs when there is a disturbance of the normal equilibrium caused by either enhanced aggression or diminished mucosal resistance.[4]

MATERIALS AND METHODS

Plant material

*Emblica officinalis*, *Terminalia chebula*, and fruits and leafs of *Murraya koenigii* were collected from Indore region, Indore, MP. All the plants were procured and ready for the extraction.

Address for correspondence:
Sachin Kumar Jain, IPS Academy College of Pharmacy, Rajendra Nagar Indore, Madhya Pradesh, India.
E-mail: sachin225819@rediffmail.com
Terminalia Chebula

Preparation of extract

The crude drugs were washed with running tap water and separated before being chopped into pieces. They were oven-dried at 45°C for 2 days and ground to powder. The ground powder was extracted with ethanol and the solvent was then removed by filtration. This ethanolic crude extract was further extracted with water, and then separated using separating funnels.

Ethanol-induced gastric lesions

Groups of rats fasted for 24 h received either *E. officinalis*, *T. chebula*, fruits and leaves of *M. koenigii* extracts (150 mg/kg), or control vehicle. After 30 min, ulceration was induced by oral administration of 50% ethanol (5 mL/kg). The animals were sacrificed after 1 h following administration of ethanol. The stomach was removed, opened along the greater curvature and sum of length of lesions (mm) was calculated and expressed as lesion index.

Pylorus Ligation in Rats

*E. officinalis*, *T. chebula*, and fruits and leaves of *M. koenigii* extracts (150 mg/kg) were administered for a period of 7 days. On day 7, after the last dose of all extracts, the rats were kept for 24 h fasting, and care was taken to avoid coprophagy. Under light ether anesthesia, the abdomen was opened, and pylorus was ligated without causing any damage to its blood vessels. The stomach was replaced cautiously, and the abdominal wall was stapled up with intermittent sutures. The animals were deprived of water throughout the post-operative stage [Table 1 and Figure 1].

CONCLUSION

In the present study, *E. officinalis* fruit extract 150 mg/kg showed prevention of gastric lesions in comparison to all other extracts groups. In addition, there is extensive experimental evidence, which indicates that certain substances through free radical scavenging protect the gastric mucosa.
REFERENCES


Formulation and Evaluation of Herbal Nail Polish Containing Herbal Ingredients

Malviya Smriti, Prajapati Bharti, Prajapati Sonu, Jain Magesh

Department of Pharmacology, College of Pharmacy, Dr. A.P.J. Abdul Kalam University, Indore, Madhya Pradesh, India

Abstract

Lavandula angustifolia dried flowers have been used for centuries in pillows and sachets to promote sleep and relaxation, and oil of spike lavender is used as an insect repellent. Family is Lamiaceae. Lavender oil is an essential oil obtained by distillation from the flower spikes of certain species of lavender. Two forms are distinguished, lavender flower oil - colorless oil, insoluble in water, having a density of 0.885 g/mL; and lavender spike oil - a distillate from the herb Lavandula latifolia, having density 0.905 g/mL. Like all essential oils, it is not a pure compound; it is a complex mixture of naturally occurring photochemical, including linalool and linalyl acetate. Kashmir lavender oil is famous for being produced from lavender at the foothills of the Himalayas. As of 2011, the biggest lavender oil producer in the world is Bulgaria. Disambiguation the beetroot is the taproot portion of the beet plant, usually known in North America as the beet, also table beet, garden beet, red beet, or golden beet. It is one of several of the cultivated varieties of beta vulgaris grown for their edible taproots and their leaves (called beet greens). These varieties have been classified as Berberis vulgaris subsp. vulgaris Conditiva Group, family Amaranthaceae.

Key words: Beta vulgaris, cosmetic, Lavandula angustifolia, nail paint

INTRODUCTION

Archaeological evidence of cosmetics certainly dates from ancient Egypt and Greece. According to one source, early major developments include the use of castor oil in ancient Egypt as a protective balm and skin creams made of beeswax, olive oil, and rosewater described by the Romans. The ancient Greeks also used cosmetics.[3,4]

Nail polish (also known as nail varnish) is a lacquer that can be applied to the human fingernails or toenails to decorate and protect the nail plates. The formulation has been revised repeatedly to enhance its decorative effects and to suppress cracking or flaking. Nail polish consists of a solution of an organic polymer and several other components, depending on the brand. Unlike many other cosmetics that have a history of hundreds or even thousands of years, nail polish (or lacquer, or enamel) is almost completely an invention of 20th century technology. Nail coverings were not unknown in ancient times-the upper classes of ancient Egypt probably used henna to dye both hair and fingernails-but essentially, its composition, manufacture and handling reflect developments in modern chemical technology.

MATERIALS AND METHODS

Selection of plant

Formula first is lavender flower and second one is beetroot which is selected on the basis of literature survey.

Collection and authentication of plants

The selected plants were collected in the month of July 2016 from the local area of Indore, Madhya Pradesh, and identified and authenticated in the Department of Pharmacognosy, Central India Institute of Pharmacy, Indore, Madhya Pradesh.

Address for correspondence:
Malviya Smriti, Collage of Pharmacy, Dr. A.P.J. Abdul Kalam University, Indore, Madhya Pradesh, India.
Table 1: Ingredients with their prescribed quantity in the formulation of herbal nail polish

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Importance</th>
<th>Quantity (ML)</th>
<th>Quantity (ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive oil</td>
<td>Viscosity, abrasion</td>
<td>0.5</td>
<td>-</td>
</tr>
<tr>
<td>Butyl acetate</td>
<td>Suitable plasticizer</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Ethyl acetate</td>
<td>Hardness and toughness</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Diethyl phthalate</td>
<td>Stiffness, flexible</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Camphor</td>
<td>Increase flexibility</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>Castor oil</td>
<td>Hardness and drying time</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>Film former, viscosity</td>
<td>-</td>
<td>0.5</td>
</tr>
<tr>
<td>Beetroot</td>
<td>Coloring agent</td>
<td>q. s.</td>
<td>q. s.</td>
</tr>
<tr>
<td>Lavender flower</td>
<td>Coloring and perfumery</td>
<td>q. s.</td>
<td>q. s.</td>
</tr>
</tbody>
</table>

q.s.: Quantity sufficient

**Formulation of herbal nail polish**

The different herbs used in the development of herbal nail polish are most important. Ethyl acetate, butyl acetate, olive oil, castor oil, camphor, diethyl phthalate, coloring, and perfumery agents are used in the formulation. Lavender flowers are used as coloring and perfumery agent, and beetroot is used as a coloring in the formulation.

The herbal nail polish was formulated as per method described. The ingredients used along with their formulation aspects had been mentioned in Table 1. All the ingredients are taken in definite ratio, and two formulations (F1–F2) were prepared.

**Characterization of herbal nail polish**

It is very essential to maintain a uniform standard for herbal nail polish, keeping this view in mind the formulated herbal nail polish was evaluated on the parameters such as drying time, smoothness, hardness, adhesion, abrasion resistance, pH parameters, water resistance, viscosity, stability, colors, skin irritant test, and perfumery test.

**RESULTS AND DISCUSSION**

The present work carries the results of “formulation, development, and evolution of herbal nail polish containing natural ingredients.” It indicates the results of use of herbal/natural ingredients in the development of nail polish with minimal or no side effects. In past few decades, there has been tremendous boost in use of cosmetics by women. However, the hazards causes by these chemicals have come into limelight very recently. The present work formulation and evaluation of herbal nail polish were aimed to formulate a nail polish using herbal ingredients with a hope to minimize the side effects as produced by the available synthetic ones. The prepared formulation [Table 1] was evaluated and it was found that the HL, F-3 was best among the five formulations. Hence, from the present investigation, it was concluded that this formulated herbal nails polish has a better option to women with minimal side effects through a detailed clinical trials may be done to access the formulation for better efficacy.

**CONCLUSION**

The usage of herbal cosmetics has been increased to many folds in the personal care system, and there is a great demand for the herbal cosmetics. The use of bioactive ingredients in cosmetics influence biological functions of skin and provide nutrients. It is necessary for the healthy skin and nails. There is tremendous scope to launch numerous herbal cosmetics using appropriate bioactive ingredients with suitable fatty oils, essential oils, proteins, and additives.

To look beautiful is the aim of every female to have a right to look gorgeous and beautiful nails.

**REFERENCES**


**INTRODUCTION**

Herbal medicine, also called botanical medicine or phytomedicine, refers to using a plant’s seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. Herbalism has a long tradition of use outside of conventional medicine. It is becoming more mainstream as improvements in analysis and quality control, along with advances in clinical research, show the value of herbal medicine in treating and preventing disease. To protect the cells and organ systems of the body against reactive oxygen species, humans have evolved a highly sophisticated and complex antioxidant protection system. It involves a variety of components, both endogenous and exogenous in origin, that function interactively and synergistically to neutralize free radicals. The Food and Drug Administration defines antioxidants only as dietary supplements to be taken in addition to normal food consumption in an effort to prevent these diseases. The aim of comparative study is to find out the best available source that can inhibit the oxidative activity of free radical generated through various metabolic processes in the living system.

**MATERIALS AND METHODS**

French beans, cluster beans, and kidney beans were bought as fresh pods from the local market of Vijay Nagar and Pipliyana, district Indore. Ascorbic acid, ethanol, trichloroacetic acid, and ferric chloride were procured from the Smriti College of Pharmaceutical Education, Indore. Ingredients used in the experiment were of laboratory grade.

All the three different beans’ pods were shade dried for 15 days; they were then grounded to uniform powder. Hydroalcoholic extraction method was used to extract out the active constituent from the powder. Extracts were further used for the antioxidant activity analyses, and results were drawn.

<table>
<thead>
<tr>
<th>Beans</th>
<th>% Yield</th>
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<tbody>
<tr>
<td>Green beans</td>
<td>1.8</td>
</tr>
<tr>
<td>Kidney beans</td>
<td>2.3</td>
</tr>
<tr>
<td>French beans</td>
<td>2.1</td>
</tr>
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**Address for correspondence:**
Kushagra Dubey, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh.
E-mail: Kushu0129@gmail.com

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*In vitro Antioxidant Activity Comparison among French Bean, Green Bean, and Kidney Bean*

Aman Parashar, Kushagra Dubey

1Department of Pharmaceutical Chemistry, Smriti College of Pharmaceutical Education Indore, Madhya Pradesh

**Abstract**

The present study was carried out with the objective to compare the antioxidant activity among kidney beans, cluster beans, and french beans. Comparison of three different beans was done to check the better available option for antioxidant in daily usage. To carry out the experiment, three different beans were subjected to shade drying; they were grounded and converted to uniform powdered form. Extractation of an active constituent was carried out by hydroalcoholic extraction method. Various dilutions of different concentrations for three different beans were prepared, and assay for antioxidant activity was carried out using ascorbic acid as a positive control. It was found that yellow color of the ferric - ferricyanide complex was changed to ferrous - ferricyanide of various shades of green and blue. The results were some more satisfactory in case of kidney beans.

**Key words:** Antioxidant, cluster bean, ferric ferricyanide, ferrous ferricyanide, french bean, kidney bean
RESULTS AND DISCUSSION

Present research was carried out to evaluate antioxidant activity of hydroalcoholic extracts of three beans. Total 20 gram power of each herb was used for extraction. Dry weight of extractives and percent yield of extractives are given in Table 1.

The reducing capacity of the extracts and fractions were performed using Fe3+ to Fe2+ reduction assay. The yellow color changes to pale green and blue color depending on the concentration of antioxidants in the samples. The Percentage inhibition is given in Table-2. The antioxidants such as phenolic acid and flavonoids were present in considerable amount in the extract of all the three beans. All the samples showed reducing capacity in a concentration dependant manner which is shown in Figure 1.

CONCLUSION

The results clearly indicated that hydroalcoholic extracts of all the three beans possess significant antioxidant activity. However, kidney beans showed maximum activity. However, further detailed investigation, especially in vivo antioxidant, and toxicity studies are needed to justify its use as a natural source of antioxidants to prevent the progression of many diseases.

<table>
<thead>
<tr>
<th>Concentration (µg/mL)</th>
<th>% Inhibition KB</th>
<th>% Inhibition CB</th>
<th>% Inhibition FB</th>
<th>% Inhibition ascorbic acid</th>
</tr>
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<tbody>
<tr>
<td>50</td>
<td>25.94±0.34</td>
<td>8.33±0.32</td>
<td>14.48±0.47</td>
<td>40.62±0.15</td>
</tr>
<tr>
<td>100</td>
<td>42.18±0.52</td>
<td>13.58±0.98</td>
<td>24.63±0.55</td>
<td>60.07±0.80</td>
</tr>
<tr>
<td>150</td>
<td>44.86±0.55</td>
<td>20.56±0.79</td>
<td>32.86±0.82</td>
<td>67.36±0.25</td>
</tr>
<tr>
<td>200</td>
<td>61.02±0.22</td>
<td>23.24±0.25</td>
<td>41.16±0.29</td>
<td>78.41±0.33</td>
</tr>
<tr>
<td>250</td>
<td>72.26±0.16</td>
<td>30.37±0.15</td>
<td>58.08±0.43</td>
<td>85.12±0.28</td>
</tr>
</tbody>
</table>

KB: Kidney beans, FB: French beans, CB: Cluster beans

Figure 1: Relation between percent inhibition and plasma concentration

REFERENCES

INTRODUCTION

Anemia affects the lives of more than 2 billion people globally, accounting for over 30% of the world’s population which is the most common public health problem particularly in developing countries occurring at all stages of the life Cycle. Anemia is a condition that develops when blood lacks enough healthy red blood cells or haemoglobin. Iron deficiency is the most common nutritional disorder in which there is a depleted and a restricted supply of iron to various tissues and which becomes apparent. This may result in depletion of Hemoglobin and iron-dependent intra-cellular enzymes participating in many metabolic pathways. Plant and plant products are being utilized as a source of medicine since long. Plant extracts are used as phototherapeutics and are still a large source of natural antioxidants. Particularly, flavonoids and phenolics are considered as potential therapeutic agents. In many developing countries, herbal medicines are assumed as greater importance in health care.

MATERIALS AND METHODS

Plant Profile

Preparation of extract

The seeds were collected, shade dried and then converted into coarse powder. The powder was then filled in a Soxhlet apparatus for extraction by 70:30 hydro-alcoholic as a solvent. The Hydro-alcoholic extract was concentrated by vacuum

PCOG-08

Antianemic Activity of Hydroalcoholic Extract Seeds of *Sesamum Indicum* in Phenylhydrazine-induced Anemic Rats

Chandrakanta Kushwah, Deepanshu Gupta, Ankur Joshi, Sapna Malviya, Anil Kharia

Department of Pharmacology, Modern Institute of Pharmaceutical Sciences (Shri Prabhat Chandra Kharia Research and Educational Society), Alwasa, Behind Rewati Range, Indore, Madhya Pradesh, India

Abstract

The main objective of this research was to evaluate the antianemic activity in a hydroalcoholic extract of seeds of *Sesamum indicum* in phenylhydrazine-induced anemic rats. Phenylhydrazine (60 mg/kg) was given intraperitoneally in rats for 2 days to induce anemia. The animal was divided into 5 groups of 6 animals each. Group 1 was known as normal control group, Group 2 was known as anemic control group, Group 3 was known as standard reference control group given with Vitamin B<sub>12</sub>, Group 4 was known as test control-I given with 100 mg/kg of a hydroalcoholic extract of seeds of *S. indicum*, and Group 5 was known as test control-II given with 200 mg/kg of a hydroalcoholic extract of seeds of *S. indicum*. All the test drugs were given for 28 days through oral route once in a day. On the 29<sup>th</sup> day, blood was taken out through the tail puncture and was subjected to the determination of red blood cell (RBC), hemoglobin (Hb), and percentage hematocrit. Both the hydroalcoholic seeds extract of *S. indicum* and Vitamin B<sub>12</sub> significantly increase the HB, RBC and percentage hematocrit level which shows that *S. indicum* seeds exhibit the antianemic activity.

Key words: Anemia, antianemic activity, hydroalcoholic extract, *Sesamum indicum*, Vitamin B<sub>12</sub>

Address for correspondence:
Chandrakanta Kushwah, Modern Institute of Pharmaceutical Sciences (Shri Prabhat Chandra Kharia Research and Educational Society), Alwasa, Behind Rewati Range, Indore, Madhya Pradesh, India.
E-mail: chandakushwah0@gmail.com
distillation to dry. The collected extract was stored in suitable container and used for further pharmacological studies.

Animals

Wistar strain male albino rats, weighing 100–150 g were selected for the study. The animals were housed individually in polypropylene cages under hygienic and standard environmental conditions (22 ± 3°C, humidity 30–70%, 12 h light/dark cycle). The animals were allowed to have standard feed and water *ad libitum*. They were acclimated to the environment for one week prior to experimental use.

Anti-anemic activity[1-3]

Anemia was induced by intra peritoneal injection of phenyl hydrazine at 60 mg/kg for 2 days.

Following the injections, rats were divided into five groups of six rats each.

Group I-Control rats received 0.1% Carboxy methyl cellulose.

Group II-Phenyl hydrazine treated rats (60 mg/kg per day for 2 days).

Group III-Phenyl hydrazine treated rats with Vitamin B12 per day for 28 days.

Group IV-Phenyl hydrazine treated rats with a single dose of seed extract of *Sesamum indicum* (100 mg/kg) per day for 28 days.

Group V-Phenyl hydrazine treated rats with a single dose of seed extract of *Sesamum indicum* (200 mg/kg) per day for 28 days.

On completion of the experimental period, the blood was collected with EDTA as an anticoagulant. Plasma was separated by centrifugation. Then Plasma was used for the estimation of various biochemical parameters like Haemoglobin, RBC and percentage Haematocrit.

Statistical Analysis

Data’s were expressed as mean ± SEM. The data were analysed by using one way analysis of variance (ANOVA) followed by Dunnet’s ‘t’ test. P values < 0.05 were considered as significant.

CONCLUSION

It has been concluded that the Hydro-alcoholic seed extract of *Sesamum indicum* exhibits anti-anemic activity against phenylhydrazine induced anemia in rats. The anti-anemic effect produced by the *Sesamum indicum* seed may be due to its high content of iron which is present in the plant.

REFERENCES


INTRODUCTION

Population is a serious problem which has grave implications related to management of food, water, health care, education, jobs, etc., in developing countries. From the traditional and reported literature, it was observed that numbers of medicinal plants are used for the contraceptive approach. The specific saponin extract from plants has been reported to possess various medicinal properties, and some of them are reported to have spermicidal potential.\(^1\-^3\) Calotropis procera (Ait.) R. Br. is a common wild growing wasteland weed belongs to family Asclepiadaceae which possess various medicinal properties. In the present work, an attempt is made for the evaluating the sperm immobilization activity of the saponin extract of \textit{C. procera} (Ait.) R. Br. leaves.

MATERIALS AND METHODS

Preparation of plant extract

The leaves were Soxhlet extracted with 70% methanol, and the extract was further solvent extracted with water-saturated n-butanol (1:1 v/v). The n-butanol phase was separated and treated with 1M KOH solution. The raw precipitates of saponin were obtained, which was dried and screened for phytochemical analysis.\(^1\-^3\)

\textbf{Address for correspondence:}\nRaghvendra Dubey, College of Pharmacy, Dr. A.P.J. Abdul Kalam University, Indore, Madhya Pradesh, India.
E-mail: raghuji22@gmail.com

Abstract

Saponin extract of \textit{Calotropis procera} (Ait.) R. Br. is evaluated for contraceptive potential by sperm immobilization assay on human semen. The leaves of wild growing plant \textit{C. procera} (Ait.) R. Br. were collected from Malwa region of Madhya Pradesh and was subjected to successive solvent extraction. The dried methanolic extract was further solvent extracted with water saturated n-butanol. The layers were separated, and n-butanol layer was acidified with 1 N KOH to obtain the raw saponin extract which was confirmed by phytochemical investigation. The extract was screened for \textit{in vitro} spermicidal activity against human spermatozoa by immobilization assay using human ejaculate in 1:1 ratio. The concentration showing motility inhibition was subjected to sperm viability assay using baker’s medium. The sperm cell plasma membrane integrity study was done by hypoosmotic swelling (HOS) test using phase contrast microscope. The specific saponin extract of \textit{C. procera} (Ait.) R. Br. at 0.1 mg/mL and 0.5 mg/mL concentration immobilize 92.22–100% and none of the spermatozoa recovered their motility in revival assay. The decrease in sperm viability was observed in range 58.06–70.12%. In HOS test significant morphological changes 65.57–72.01% were observed under phase contrast microscope. The present finding has pointed out that saponin extract shows good human spermatozoa immobilization capacity at concentration 0.5 mg/mL and 0.1 mg/mL in 20 s and 2 min, respectively. The damage to the sperm membrane architecture and impairment of the functional integrity of the plasma membrane was evidenced by a significant reduction in sperm viability and tail curling.

Key words: Human spermatozoa, hypo-osmotic swelling test, saponin extract, sperm immobilization
Immobilization assay

The normal human ejaculates sperm was mixed with the saponin extract of concentration 0.1 mg/mL and 0.5 mg/mL in 1:1 ratio. Drop of the mixture was placed immediately on a pre-warmed slide, and five fields were microscopically observed for assessment of sperm motility at a time interval of 20 s and 2 min. The sample showing motility inhibition was subjected to sperm revival test by incubating at 37°C for 30 min with bakers medium.\(^1\)\(^-\)\(^3\)

Sperm HOS and viability analysis

The extract treated sperm samples at a ratio of 1:1 were mixed with 1 mL of HOS medium and incubated for 30 min at 37°C. The inflamed curling tails were examined under phase contrast microscope. Sperm viability test was performed by mixing extract treated sperm sample with eosin Y dye and observed under ×400 magnification.\(^1\)\(^-\)\(^3\)

RESULTS

The saponin extract at 0.1 mg/mL and 0.5 mg/mL concentration was able to immobilize 92.22–100% of the human spermatozoa showed in Table 1. None of the spermatozoa, once immobilized, recovered their motility within 30 min of incubation. The significant decrease in sperm viability 58.06–70.12% was observed which indicates the spermicidal property of extracts. Under HOS medium typical morphological changes were observed, and tail curling was significantly reduced from 65.57% to 72.01% \((P < 0.001)\), indicating the impairment of the functional integrity of the plasma membrane.

CONCLUSION

The saponin extract of \(C.\) procera (Ait.) R. Br. showed potent spermicidal property against human spermatozoa at a concentration of 0.5 g/mL and 0.1 g/mL in 20 s and 2 min, respectively. It was concluded that the damage to the membrane architecture was evidenced by the significant reduction in sperm viability and tail curling. The lost of sperm plasma membrane integrity will surely reduce the ability of the cells to induce acrosome reaction and fertilization.

REFERENCES


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**Table 1: Sperm immobilization, viability, and HOS test of saponin extract of \(C.\) procera**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>0.1 mg/mL</th>
<th>0.5 mg/mL</th>
<th>Solvent</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 s</td>
<td>2 min</td>
<td>20 s</td>
<td>2 min</td>
</tr>
<tr>
<td>% M</td>
<td>07.778±0.18</td>
<td>0</td>
<td>1.167±0.12</td>
<td>0</td>
</tr>
<tr>
<td>% Im</td>
<td>92.22±0.56</td>
<td>100</td>
<td>98.83±0.22</td>
<td>100</td>
</tr>
<tr>
<td>% IIm</td>
<td>72.092±0.68</td>
<td>79.87±1.20</td>
<td>78.703±0.96</td>
<td>79.87±1.20</td>
</tr>
<tr>
<td>% SV</td>
<td>27.64±0.48</td>
<td>16.24±0.36</td>
<td>18.34±0.86</td>
<td>16.12±0.58</td>
</tr>
<tr>
<td>% RSV</td>
<td>58.06±0.32</td>
<td>70.00±0.34</td>
<td>67.90±0.18</td>
<td>70.12±0.84</td>
</tr>
<tr>
<td>% HOS</td>
<td>22.64±0.72 (1%)</td>
<td>16.20±0.44 (2%)</td>
<td>88.21±0.64</td>
<td>-</td>
</tr>
<tr>
<td>% RHOS</td>
<td>65.57±0.54 (1%)</td>
<td>72.01±0.28 (2%)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

% M: Percentage motility, % Im: Percentage inhibition in motility, % IIm: Increase in percentage inhibition in motility, % SV: Sperm viability, % RSV: Reduction in percentage sperm viability, % HOS: Percentage hypoosmotic swelling, % RHOS: Reduced percentage hypoosmotic swelling, % mean of three replicates±SEM. \(C.\) procera: Calotropis procera
INTRODUCTION

The traditional Indian system of medicine, the Ayurveda, mentions the use of plants in the treatment of various diseased conditions. Ethnobotanical research done in past few decades has revealed the analgesic properties of plants cited in the traditional literature. Many herbal preparations are being prescribed as an analgesic in the traditional literature.[1] *Hibiscus syriacus* Linn. (Family: Malvaceae) is commonly known as rose of sharon. Rose of Sharon is valued for large flowers produced in summer when few other shrubs bloom. It is useful as a garden accent due to its strict, upright habit. The open, loose branches and light green leaves make rose of sharon ideally suited to formal or informal plantings, and with a little pruning makes an attractive, small specimen tree.[2] *Hibiscus*, especially white hibiscus, is considered to have medicinal properties in the Indian traditional system of medicine, Ayurveda. Roots make various concoctions believed to cure various ailments.[3]

MATERIALS AND METHODS

The present study is based on traditional knowledge of the plant. The study reveals the potency of ethanolic extract of *H. syriacus*. Ethanolic extract of *H. syriacus* is preparing by hot percolation method.

Collection and authentication of plant materials

The leaves of *H. syriacus* L. collected from the months of August–September from the Garden of Jawaharlal Institute of Technology and G. R. Y. Institute of Pharmacy Vidya Vihar Borawan district Khargone, Madhya Pradesh. The plant *H. syriacus* L. was identified and authenticated by Dr. S.K. Mahajan, Retd Botanist from Government Science and Arts College, Khargone, Madhya Pradesh.

Preparation of crude extract

It was passed through the 40 mesh sieve dried and powered flowers defatted first to remove fatty material, and for this purpose, 100 g of weighed powered flowers of *H. syriacus* L. was packed in Soxhlet apparatus and extracted with petroleum ether then ethanol. A total of 100 g of dried flowers were soaked in 500 mL of hot water which was then boiled for 24 h and kept for 24 h undisturbed and then filtered through sterile filter paper [Table 1].

Determination of analgesic activity by tail flick method

Twenty four healthy Wistar albino rats weighing between 150 and 200 g were divided into six groups each comprising six rats with 1:1 sex ratio. The tail flick latency was assessed

## Key words: Analgesic activity, *Hibiscus syriacus*, Malvaceae, Wistar albino rats

Abstract

The plant *Hibiscus syriacus* Linn. belongs to family “Malvaceae” and considering various medicinal properties of this plant. We assayed in vivo analgesic activity by tail flick method of *H. syriacus* L. extract using diclofenac sodium as references. *H. syriacus* Linn. extract has stronger analgesic activity on concentration-dependent manner. Analgesic activities of *H. syriacus* Linn. were much closed to the diclofenac sodium. Hence, we can conclude that the in vitro study emphasized *H. syriacus* Linn. effective analgesic activity which may be due to its phenolics and flavonoids contents.

## COLLECTION AND AUTHENTICATION OF PLANT MATERIALS

The leaves of *H. syriacus* L. collected from the months of August–September from the Garden of Jawaharlal Institute of Technology and G. R. Y. Institute of Pharmacy Vidya Vihar Borawan district Khargone, Madhya Pradesh. The plant *H. syriacus* L. was identified and authenticated by Dr. S.K. Mahajan, Retd Botanist from Government Science and Arts College, Khargone, Madhya Pradesh.

## PREPARATION OF CRUDE EXTRACT

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## DETERMINATION OF ANALGESIC ACTIVITY BY TAIL FICK METHOD

Twenty four healthy Wistar albino rats weighing between 150 and 200 g were divided into six groups each comprising six rats with 1:1 sex ratio. The tail flick latency was assessed
Table 1: Determination of analgesic activity by tail flick method

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Dose (mg/kg)</th>
<th>Reaction time (seconds) ± SEM (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Control (vehicle)</td>
<td>-</td>
<td>0.88±0.24</td>
</tr>
<tr>
<td>1</td>
<td>Standard (diclofenac sodium)</td>
<td>100</td>
<td>0.96±0.10</td>
</tr>
<tr>
<td>2</td>
<td>Methanol extract</td>
<td>500</td>
<td>4.27±0.60*</td>
</tr>
<tr>
<td>3</td>
<td>Aqueous extract</td>
<td>500</td>
<td>1.59±0.11*</td>
</tr>
</tbody>
</table>

Values are±SEM; n=6 in each group; all drugs given 30 min prior to administration of the drug. *P<0.05, **P<0.001 values are compared with control groups.

RESULTS AND DISCUSSION

The plant *H. syriacus* flowers extract shows significant and dose-dependent analgesic activity in all the tested models; as illustrated in Table 1. The reaction time of animal showed significant increases with increasing duration. All extracts of *H. syriacus* flowers showed dose-dependent analgesic activity and have shown a maximum effect at 240 min after administration of the drug. When compared with all another extract, ethanol extract showed significant analgesic activity (5.25 ± 1.37 s) at a dose of 500 mg/kg body weight. Aqueous extract is having analgesic activity but not much significant as ethanolic flowers extract.

REFERENCES

INTRODUCTION

Pain is the part of a protective reaction against dysfunction of an organ or imbalance in its functions against the potentially dangerous stimulus. It is an unpleasant feeling often associated with tissue damage. The drugs that selectively relieve pain by acting on the central nervous system are called as analgesics. It also acts on peripheral pain mechanisms, without significantly altering consciousness. Analgesic relieves pain as a symptom not cure the cause of pain. Analgesics are of two type opioid analgesic or non-opioid analgesic. In recent times, focus on plant research has increase. Herbal drugs are being proved as effective as synthetic drugs with lesser side effects. Herbal medicines are in line with nature, with less hazardous reaction. The use of herbal medicines worldwide has provided a great opportunity to India to look for therapeutic conduct compounds from our oldest system of therapy, i.e. Ayurveda, which can be utilized for the development of new drug.

MATERIALS AND METHODS

Experimental animal

Wister albino rats weighing 150–200 g were housed in standard cages at room temperature 22 ± 2°C and 50 ± 5% relative humidity, under a light/dark cycle of 10/12 h, for 1 week before the experiments. Animals were provided with standard rodent pellet diet (Indore, India), and water ad libitum.

Evaluation of analgesic activity

**Hot plate method** [1,2]

The analgesic activity of the given drug was determined by the basal reaction time. A total of 24 rats of either sex were divided into four groups. Group I was kept as control, administered with distilled water (10 mL/kg) and Group II was treated with standard drug pentazocine (10 mg/kg). Group III and IV were treated with two different concentrations of hydroalcoholic extract of lycium barbarum (200 mg/kg and 400 mg/kg body weight) orally 30 min before the start of the experiment. The heated hot plate, maintained at 55±0.5°C was used to induce pain. Before the treatment, the reaction time of each animal (paw licking or jumping) was recorded. The reaction time was recorded at 1, 2, 3, and 4 h following the administration of hydroalcoholic extract of lycium barbarum and pentazocine. To minimize damage to the animal paw, the cutoff time for latency was taken as 25 s.

Key words: Analgesic, hydroalcoholic extract, Lycium barbarum, pentazocine

**Address for correspondence:**

Sirvi Someshver, Modern Institute of Pharmaceutical Sciences, Indore, Madhya Pradesh, India.

E-mail: jaysirvi87@gmail.com
Tail flick method

Wister rat was screened for sensitivity test by placing the tip of the tail on the radiant heat source. Any animal that failed to withdraw its tail within 5 s was rejected from the study. The selected animals were then divided into four groups of six rats each. Each of the groups received one of the following: Extract (200 and 400 mg/kg), pentazocine (standard, 10 mg/kg), and distilled water (control) in normal saline intraperitoneally. Basal reaction time was measured initially (0 min) and at 15, 30, 45, and 60 min. A cutoff period of 10 s was observed to avoid damage to the tail.

RESULTS

Analgesic activity

The analgesic activity was performed by hot plate method and tail flick method which shows dose-dependent pain inhibition with ethanol extract as mentioned in Tables 1 and 2.

Percentage pain inhibition = \( \frac{\text{Control reading} - \text{test reading}}{\text{Control reading}} \times 100 \)

CONCLUSION

The present experimental study protocol showed that hydroalcoholic extract of L. barbarum elicited significant analgesic activity in Eddy’s hot plate model and tail flick latency model. In both model, they exhibited an analgesic effect in a dose-dependent manner which can be comparable with that of pentazocine. On preliminary phytochemical screening, the hydroalcoholic extract of L. barbarum was found to contain sterols and triterpenes compounds.

REFERENCES

INTRODUCTION

In present scenario majority of the population in developing countries depends on medicinal plants based drugs and their formulations for their primary health care needs. Nowadays, demand for these medicinal plants based drugs is increasing day by day due to their healing properties. *Anogeissus latifolia* (DC.) is medium-sized deciduous tree of genus *Anogeissus*. It is commonly called as “dhau” widely used in Indian traditional system of medicine.

EXPERIMENTAL METHODS

Preliminary phytochemical screening of acetone and chloroform extracts of both stem bark and leaves were screened for the presence of phenols, tannins, alkaloids, carbohydrates, saponins, amino acids, steroids, flavonoids, coumarins, quinone, furanoids, and terpenoids by the standard methods. Total phenolic and total flavonoid contents were estimated spectrophotometrically using Folin–ciocalteu assay and aluminum chloride assay method, respectively. High-performance thin-layer chromatography (HPTLC) fingerprinting profiles of acetone and chloroform were developed in suitable mobile phase using standard procedures and visualized in ultraviolet (UV) 254 nm, 366 nm and in white light after derivatization within vanillin-sulfuric acid reagent.

RESULTS AND DISCUSSION

Phytochemical examination of different extracts of stem bark and leaves showed the presence of similar phytoconstituents except phenol and tannins was absent in chloroform extracts of stem bark. Comparative evaluation of HPTLC profiles of acetone and chloroform extracts of leaves and stem bark.
carried out to reveal the chemical pattern showed many similar bands which again indicate the presence of many similar compounds in leaves and stem bark of *A. latifolia* (Roxb.). Good quantity of active phytochemicals such as total phenolics and total flavonoids in stem bark and leaves are summarized in Table 1.

The chemical constituents of the *A. latifolia* (Roxb.) were compared by TLC analysis. The TLC fingerprints of the different extracts of the *A. latifolia* (Roxb.) with $R_f$ value are discussed in Figure 1a-i.

### CONCLUSION

Phytochemical investigation and HPTLC fingerprinting of both extracts of stem bark and leaves of *A. latifolia* (Roxb.) suggest that leaves may have a lot of similar active phytoconstituents like stem bark and may be used as an alternate of stem bark after evaluation and confirmation of same for pharmacological activities.

### REFERENCES


### Table 1: Total phenolic and total flavonoid content of acetone and chloroform extracts of stem bark and leaves of *A. latifolia* (Roxb.)

<table>
<thead>
<tr>
<th>Plant parts</th>
<th>Extracts</th>
<th>Total phenolics mg of GAE/g dry weight*</th>
<th>Total flavonoids mg of QUE/g dry weight*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem bark</td>
<td>Acetone</td>
<td>120.54±2.27</td>
<td>88.24±2.84</td>
</tr>
<tr>
<td>Leaves</td>
<td></td>
<td>111.67±2.43</td>
<td>67.28±3.06</td>
</tr>
<tr>
<td>Stem bark</td>
<td>Chloroform</td>
<td>86.26±2.44</td>
<td>54.64±2.32</td>
</tr>
<tr>
<td>Leaves</td>
<td></td>
<td>77.27±1.32</td>
<td>42.28±4.24</td>
</tr>
</tbody>
</table>

*A. latifolia: Anogeissus latifolia.* *Values are expressed as mean±SD, SD: Standard deviation*

### Figure 1: (a-i) High-performance thin-layer chromatography chromatograms of acetone and chloroform extracts of leaves and stem bark of *Anogeissus latifolia* (Roxb.) with $R_f$ value at UV 254 nm, 366 nm and after derivatization with vanillin-sulfuric acid (track 1, 2 acetone extracts of leaves, stem bark, and track 3–4 chloroform extracts of leaves and stem bark)
INTRODUCTION

Various materials from plant source such as henna, chamomile, and indigo are widely used to dye the gray hair from ancient time, but instead of blackening the hair, they impart red to copper color. Hair graying is caused by various reasons such as genetic influence, environmental factors, unhealthy lifestyle, and consumption of alcoholic preparation. Many synthetic and semi-synthetic hair dyes are available in the market, but their prolonged and frequent use causes various side effects such as hypersensitivity reaction, skin irritation, erythema, loss or damage of hair, and skin cancer. Some products marketed as herbal dyes are also available but either they are not completely free from synthetic chemicals or their color is not stable for long time. The main objective of the present study is to develop a 100% herbal and effective hair dye to overcome the drawbacks of presently marketed synthetic and semi-synthetic dyes. Various dye formulations were prepared using different quantitative composition of herbal ingredients, i.e., indigo, henna, amla, bhringraj, hibiscus, neem, methi, walnut, and coffee. The hair coloring effect and color stability of prepared hair dyes were further evaluated and compared with a marketed product (as reference), i.e. herbal black mehandi (Khadi Gramodyog) which contains para-phenylenediamine a synthetic chemical as a coloring agent. The developed herbal hair dye was found to be more effective and stable hair coloring agent and therefore, may be concluded as better, safe, and user-friendly product.

Key words: Bhringraj, hair graying, henna, herbal hair dye, indigo

MATERIALS AND METHODS

Plant material

Leaves of henna, neem, and indigo, fruits of amla, flowers of hibiscus, walnut fruit, coffee beans, and whole plant of bhringraj were used.
Method

Various herbal dye formulations using different quantitative composition of herbal ingredients (as shown in Table 1) were prepared by very simple, easy, and inexpensive method. All herbal materials, henna, indigo, amla, bhringraj, hibiscus, neem, and coffee were collected and dried completely. Each dried herbal material was finely powdered separately and sieved to remove gritty particles. All ingredients were accurately weighed and mixed properly to yield a uniform fine powder mixture and then packed in a moisture resistance pouch and stored in a cool dry place, away from moisture. The product was ready to use. Similarly, all formulation samples, i.e., sample 1–5 (Table 1) were prepared and were compared with sample-6 (as reference), i.e., herbal black mehndi (Khadi Gramodyog).

Evaluation of herbal hair dye

Gray hairs were collected from a barber shop, and the hair specimens were bunched with the help of paper clip to form six bundles [Figure 1]. The hair bundles were then labeled properly as sample 1–6 for application of formulated hair dyes in sample 1–5 and marketed dye in sample 6. After applying the dye samples, the hair bundles were washed thoroughly with a mild shampoo, rinsed with water and dried. Washing and drying of hair bundles were done each alternate day and were continued for 1 month. The observation of hair color after 1, 3, 5, 10, 20, and 30 days is shown in Figure 2.

RESULTS AND DISCUSSION

After application of developed hair dye formulations and subsequent washing on alternate days, it was compared for the intensity of color with marketed products containing PPD. The observations on the 30th day showed that hair dye sample-3 retained dye color on hairs and equally comparable with the marketed product, i.e., herbal black mehndi.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Sample-1</th>
<th>Sample-2</th>
<th>Sample-3</th>
<th>Sample-4</th>
<th>Sample-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amla</td>
<td>15</td>
<td>20</td>
<td>15</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Bhringraj</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Hibiscus</td>
<td>5</td>
<td>10</td>
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<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Henna</td>
<td>40</td>
<td>30</td>
<td>40</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>Methi</td>
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<td>Coffee</td>
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<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
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</tr>
</tbody>
</table>

Figure 1: Gray hair bindles (sample 1–6) before and after application of hair dye

Figure 2: Observations of hair color on different duration after each alternate days washing
(Khadi Gramodyog). It has good organoleptic properties, spreadability, stability, and free from grittiness.

**CONCLUSION**

It can be concluded from the study performed that the developed herbal hair dye is effective, stable, and economic and imparts hair coloration for a prolonged time. As it avoids the use of synthetic chemicals, it may also be claimed to be non-toxic, safe, and free from side effects and therefore, would be considered as a better alternative to presently marketed hair dyes.

**REFERENCES**

INTRODUCTION

Wound is a full or partial interruption in the integrity of the skin; there are various drugs obtained from plant source which are known to increase the healing of different types of wounds. For standard health care, herbal medicines have integral part, based on a combination of time-honored traditional uses and ongoing scientific research. The leaves and routes contain tannins (argimonin and pedunculagin), Vitamin C, traces of oil, flavonoids (quercetin and rutin), and phenolic acid.

METHODS

Experimental animals

18 male Wistar rats (150–200 g) were divided into three groups of six rats. The animals were housed in standard environmental condition. During the course of the experiment, the rats were administered a standard pellet diet and water ad libitum.

Surgical procedure

The rats were anesthetized by thiopental sodium and then fixed in a ventral posture on a surgery table anesthesia was given in the depth of muscle, avoiding incision of the muscle layer itself, and tension of skin was kept constant during the procedure. An area of uniform wound 2 cm in diameter was excised from the neck.

On day 5, 10 and 15, and 21 four animals were randomly selected for observation of percentage of healing of wound on the rats [Table 1].

\[
\text{Wound size at day zero (0)} - \text{Wound size on the given day} \\
\text{Wound size on day zero (0)} \times 100
\]

RESULTS AND DISCUSSION

The effect of hydroalcoholic Fragaria ananassa leaves extracts ointment on excision wound model, the wound healing contracting ability in different contraction was significantly greater than that of control. The 10% w/w extract ointment treated groups showed significant wound healing from 4th day onward, which was comparable to that of the standard drug, povidone-iodine ointment treated groups of animals. Closure time of the wound was lesser,

Address for correspondence:
Shekhar Priyanshu, Modern Institute of Pharmaceutical Sciences, Indore, Madhya Pradesh, India.
E-mail: priyanshupatna011@gmail.com
and the wound contraction percentage was much more with the 10% w/w extract ointment treatment group. The result of present study revealed that hydroalcoholic extract of *F. ananassa* leaves has significant wound healing activity excision wound model.

**CONCLUSION**

The results of the study showed that the hydroalcoholic extract ointment of *F. ananassa* leaves effectively stimulates wound contraction as compared with the control group. These finding could justify the inclusion of this plant in the management of wound healing.

**REFERENCES**

INTRODUCTION

Wound is a type of injury in which skin is torn, cut or punctured (an open wound), or when blunt force trauma causes a contusion (a closed wound). In pathology, it specifically refers as sharp injury which damages the dermis of the skin.[1] The wound healing is a part of homeostatic mechanism of body in which the skin (or another organ) repairs itself after injury. In normal skin, the epidermis (outermost layer) and dermis (inner or deeper layer) exist in steady state equilibrium, forming a protective barrier against the external environment. Wounds are classified as open and closed wound on the underlying cause of wound creation and acute and chronic wounds on the basis of physiology of wound healing.[2]

MATERIALS AND METHODS

Excision wound model

Excision wound models were used to evaluate the wound healing activity. Excision wound model was employed to have information about wound contraction and wound closure time on the eight groups of animals. The animals were anesthetized using diethyl ether. An impression was making on the dorsal thoracic region 1 cm away from vertebral column and 5 cm away from ear on the anesthetized rat. The particular skin area was shaved 1 day before the experiment. The skin of impressed area was excised to the full thickness to obtain a wound area of about 500 mm². Homeostasis was achieved by blotting the wound with cotton swab soaked in normal saline. Animals were treated daily with drugs as mentioned above under experimental design from 0th day to 15th post-wounding day. Wound area is measured on 15th day post wounding for determination of wound contraction, and percentage wound contraction was calculated. Falling of scar leaving no raw wound behind was taken as end point of complete epithelization and the days required for this was taken as period of epithelization.

RESULTS

Effect on wound area (mm²) was showed in Table 1 which revealed that Lantana camara flower ethanolic extract significant decrease in wound area. Effect on percentage wound closure was showed in Table 2 which revealed that Lantana camara flower ethanolic extract significant decrease wound closure as compared to control. Test ointment showed complete epithelization 17.00 ± 0.1** days when compared to control (22 ± 1.0*** and standard (14.80 ± 0.08***).

Address for correspondence:
Kumayu Teena, Modern Institute of Pharmaceutical Sciences, Indore, Madhya Pradesh, India.
E-mail: aarohi15mips@gmail.com
epithelialization in days was showed in Table 3 which showed significant result in test group.

**DISCUSSION**

Wound healing involves various phases. Initially involves acute inflammatory phase followed by the synthesis of collagen and other extracellular macromolecules, which are later removed to form a scar. Drugs, which influence one phase, may not necessarily influence another. Hence, different models have been used in our study to assess the effect of various phases. The treated group of wound showed complete healing of wounds with almost normal architecture of the collagen, reticulin. Increase in tensile strength of treated group wound may be due to increase in collagen concentration.

The present study shows confirm that ethanolic extract of *L. camara* involved in the all the phases of wound healing and the promising wound healing activity may be attributed to the presence of different phytoconstituents such as flavonoids and tannins.

**CONCLUSION**

From the study carried out showed that the ethanolic extract of *L. camara* possesses a significant wound healing activity, thereby justifying its use of the ethanolic extract of *L. camara* in the treatment of wound healing.

**REFERENCES**

Pharmacological Efficacy of Methanolic Extract of Plant Bombax Ceiba Against Isoproterenol-induced Cardiac Toxicity in Rats

R. Birla, R. Badore, N. Malviya, N. Bhadore, P. Das, S. Pillai

Department of Pharmacology, GRY Institute of Pharmacy, Borawan, Khargone, Madhya Pradesh, India

Abstract

Bombax ceiba is a potent antioxidant dietary source for human health. The present research was designed to evaluate the cardioprotective role of chronic oral administration of B. ceiba flower extract against isoproterenol (ISO)-induced myocardial injury. B. ceiba extract in all three dose shows protective mechanism through decreasing thiobarbituric acid reactive substance and enhancing the endogenous antioxidant enzymes. Thus, the study shows that B. ceiba extract exhibits significant antioxidant activity and protects the heart from free radical-mediated toxicity of ISO.

Key words: Antioxidant, Bombax ceiba, cardiotoxicity, isoproterenol

INTRODUCTION

Myocardial infarction (MI) is the acute condition of necrosis of the myocardium that occurs as a result of imbalance between coronary blood supply and myocardial demand. ISO damages the myocardial through calcium accumulation in cytosolic membrane, generation of reactive oxygen species and procogulant activity. Bombax ceiba L. (Family Bombacaceae) is the one of oldest existing seed plants, also known as “living fossils.” It contains flavonol and flavone glycosides, saponins, tannins, gums, arabinopyranose, and iron-based superoxide dismutase. B. ceiba has been reported to have antioxidant, antimicrobial, hepatoprotective, hypotensive, cytotoxic, hypoglycemic, and analgesic.

MATERIALS AND METHODS

Drugs and chemicals

Flower of Bombax ceiba was collected from Khargone (M.P.), India, and was authenticated by Dr. S. K. Mahajan M Sc, Ph.D, Department of Botany, Government P. G. College, Khargone, M.P., India.

Extract preparation

Dried flower of B. ceiba was coarsely powdered, and 1 kg of this powered plant material was extracted with the help of the Soxhlet apparatus using methanol as a solvent. The solvent from the methanolic extract was removed under vacuum distillation; dried material was kept in a desiccators. A suspension of the flower in 5% Tween 80 (Vehicle) was made daily.

Experimental animals

Male Wistar albino rats of body weight 150–200 g were obtained from the Institute Animal House. The rats were acclimatized in the department animal house at an ambient temperature of 25°C, under a 12 h dark - 12 h light, cycle, for the whole period of the study. The experiment was carried out according to the guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), New Delhi, India, and the research protocol was approved by the Institute Animal Ethical Committee (1151/ac/07/CPCSEA).

Experimental protocol

The rats were divided into 5 groups (6 in each group) and fed with the suspension of B. ceiba flower extract of three

Address for correspondence:
R. Birla, GRY Institute of Pharmacy, Borawan, Khargone, Madhya Pradesh, India.
E-mail: prabhat3027@yahoo.com
doses (125 mg/kg, 250 mg/kg, and 500 mg/kg) by oral gavages once a day for 4 weeks (6 days/week). At the end of the treatment period, rats from all groups except control group were administered isoproterenol (ISO) 85 mg/kg i.p., for 2 consecutive days to induce myocardial injury. After 48 h of the first dose of ISO, the rats were sacrificed; hearts and blood samples were collected and immediately frozen in liquid nitrogen for biochemical estimation.

### Treatment protocol

The groups studied were as follows:
- **Group GI**: Control, vehicle + saline-injected rats
- **Group GII**: Vehicle + ISO-treated rats (85 mg/kg)
- **Group GIII**: 125 mg/kg of MEBC + ISO-treated rats (85 mg/kg)
- **Group GIV**: 250 mg/kg of MEBC + ISO-treated rats (85 mg/kg)
- **Group GV**: 500 mg/kg of MEBC + ISO-treated rats (85 mg/kg).

### RESULTS

The results obtained in the different groups subjected to in vivo ischemic reperfusion injury are presented.

### CONCLUSION

In this respect, the present study showed for the first time that the flower of *B. ceiba* is particularly useful agents, as they could enhance myocardial and blood endogenous antioxidants level without producing any cytotoxic effects. Therefore, the protection against myocardial injury in the treated rats is attributed to enhanced endogenous antioxidant activity. Hence, we concluded that this study of Bombax ceiba can help for further research area in cardiovascular and another disease which caused due to oxidative stress.

### REFERENCES


An *in vitro* Anti-inflammatory Activity of Methanolic Extract and Various Fractions of *Centella Asiatica* Leaves by Protein Denaturation

Shivani Sharma¹, Rahul Trivedi²

¹Department of Quality Assurance, Mandsaur University, Mandsaur, Madhya Pradesh, India, ²Department of Pharmacology, Mandsaur University, Mandsaur, Madhya Pradesh, India

Abstract

Inflammation has long been a widely known symptom of the many infectious diseases. Inflammation may be a complicated biological response to dangerous stimuli such as pathogens and damaged tissues. *Centella asiatica* (CA) is one of the oldest Ayurvedic medicinal plants, used in treatment of various skin disease, nervine tonic, etc. The aim of our present study was to evaluate the *in vitro* anti-inflammatory activity of methanolic extract and their fractions of CA leaves. The anti-inflammatory activity was evaluated by protein denaturation method. In the present study, the percentage inhibition for methanolic extract was found to be 40.22%. The percentage inhibition for petroleum ether and n-butanol fraction of methanolic extract was found to be 54.12% and 44.42%, respectively, at 500 µg/mL. The diclofenac sodium which was used as a standard drug in the activity had shown maximum activity as compared to petroleum ether and n-butanol fraction.

Key words: *Centella asiatica*, n-butanol fraction, protein denaturation

INTRODUCTION

Inflammation has long been a widely known symptom of the many infectious diseases. Inflammation causes mainly itching, swelling, skin redness, warm, and slight pain. Inflammation is a common disease caused by any viral and fungal infection and by any physical and chemical agents. Protein denaturation is a process in which protein lose their tertiary structure and secondary structure when applied any external stress or compounds, such as any strong acid or base, heat, and organic solvent or inorganic salt. *Centella asiatica* (CA) is a perennial herb belonging to the family Apiaceae, widely grow in moist places in India, South Africa, and Sri Lanka, etc. It is also known as mandukaparni, jal brahmi, and Gotu kola. The active constituents of CA include triterpenoids, saponin, volatile oils, tannins, amino acids, sugars, and flavonoids.¹⁻³

MATERIALS AND METHODS

Procurement of material and collection of chemicals

The dried leaves of CA were purchased from the local market of Mandsaur, India. Methanol and other organic solvents like petroleum ether, chloroform, and n-butanol were of analytical grade.

Preparation of extract and fractionization of extract

CA leaves were grinded, and the powder was loaded into Soxhlet apparatus and methanol used as a solvent. After extraction, the extract was filtered and concentrated on water bath to get a dried residue. The dried methanolic

Address for correspondence:
Shivani Sharma, Department of Quality Assurance, Mandsaur University, Mandsaur, Madhya Pradesh, India. E-mail: shivanisharma327@gmail.com
Extract (100 g) of CA was suspended in distilled water and filtered to remove the insoluble material. The water fraction was separated using separating funnel and fractionized by different solvents (petroleum ether, chloroform, n-butanol, and water).

**Assessment of in vitro anti-inflammatory activity**

**Inhibition of albumin denaturation**

Bovine serum albumin solution of 0.2% w/v was prepared in Tris buffer saline and pH was maintained by glacial acetic acid (pH 6.8). Stock solutions of 10,000 μg/mL of all extract were prepared using respective solvents. By stock solutions five different concentrations (100, 200, 300, 400, and 500 μg/mL) were prepared and transferred 50 μL of all extract in Eppendorf tube by micropipette. Then, add 5 mL of 0.2 w/v BSA solution in each Eppendorf tube. 5 mL of 0.2% w/v BSA solution with 50 μL of different fractions considered as control. The standard consists of 100 μg/mL of diclofenac sodium in different solvents with 5 mL of 0.2% w/v of BSA solution And then heated at 72°C for 5 min. After cooling, the absorbance of all fractions of different concentrations was measured using ultraviolet-visible spectrophotometer at 660 nm and recorded.

The percentage inhibition of protein denaturation was calculated using the following formula:

\[
\text{% Inhibition} = \left(1 - \frac{\text{Abs of control} - \text{Abs of test}}{\text{Abs of control}}\right) \times 100
\]

**RESULTS AND DISCUSSION**

The methanolic extract as well as petroleum ether and n-butanol fractions were effective in inhibit the heat induced albumin denaturation at various concentrations. Petroleum ether fraction showed the greater inhibition and n-butanol fraction showed remarkable inhibition at 500 μg/mL. Diclofenac sodium (standard) showed the maximum inhibition 55.88% at concentration of 100 μg/mL. The results are mentioned in Table 1.

**CONCLUSION**

The active constituents of CA such as flavonoids, terpenoids, and saponins might be responsible for this activity. The study concluded that the methanolic extract of petroleum ether and n-butanol fraction possessed good anti-inflammatory action.

**REFERENCES**

INTRODUCTION

The aim of the present context is to evaluate the hepatoprotective potential of the ethanolic extract of \textit{Moringa pterygosperma} whole plant in a conventional animal model of hepatopatotoxicity. \textit{M. pterygosperma} belongs to onogeneric family of shrubs and tree, Moringaceae, and is considered to have its origin in Agra and Oudh, in the northwest region of India, and south of the Himalayan Mountains. They are an exceptionally good source of provitamin A, Vitamins B, and C, minerals (in particular iron), and the sulfur-containing amino acids methionine, and cystine. In traditional Indian medicine, various parts of the tree are used therapeutically, including for treatment of ascites, rheumatism, venomous bites, and as cardiac, antidiabetic, and circulatory stimulants.

MATERIALS AND METHODS

The whole part of plant \textit{M. pterygosperma} plant was collected from young matured plant from the rural belt of Balasore, Orissa during the months of January–February and identified by the botanist of Khargone PG College by comparing with the voucher specimen present in the herbarium. Healthy albino male rats of Wistar strain weighing between 150 and 200 g were selected for the investigation. Extraction of plant material and preparation of test dose about 200 g of coarse dried powder of whole plant of the \textit{M. pterygosperma} was taken in the Soxhlet apparatus and extracted successively using the selected solvents in order (i.e. Pet. ether, chloroform, and ethanol).
Hepatoprotective activity study

A total of 30 rats were divided randomly into 5 groups, each comprising 6 animals. Group I (normal control) received oral dose of 0.5% sodium CMC (1 mL each) for 7 days. Group II (toxic control) received single dose of CCl₄ (CCl₄ + olive oil in 1:1 ratio; 2 mL/kg of body wt; i.p.) on day 1 and day 7 of the experiment Group III, and IV received standard polyherbal drug “Liv-52” (5 mL/kg; p.o.), ethanolic extract 250 mg/kg of body wt. once in a day for 7 days, respectively, along with the i.p dose of CCl₄ on day 1 and day 7 as mentioned above. The treatment duration was of 7 days. On the 8th day of the study, the animals were sacrificed under anesthesia, and blood samples were collected from each animal to produce the serum for biochemical assay.[2-4]

RESULTS AND DISCUSSION

The biochemical assays of hepatoprotective study were performed on the 8th day. A significant elevation in serum AST, serum ALT, serum ALP levels and significant decrease in serum total protein, and serum albumin level followed by significant weight loss were found in toxic control group, when compared with the normal control group. The EEMP₂₅₀ group (ethanolic extract of the plant 250 mg/kg treated rat group), the final body wt. was significantly elevated, when compared with the toxic control group. The serum total protein and the serum albumin were almost approaching normal values and comparable with the results observed in standard group. Serum AST and serum ALT were found to be significantly lower, and serum ALP level was also significantly decreased (when compared with the toxic control group), approaching almost normal values as that of observed in case of standard group, supports the restoration of normal hepatic functions.

CONCLUSION

At the end of our study, a strong conclusion can be drawn that, the ethanolic extract of *M. pterygosperma* possess hepatoprotective activities at a dose level of 250 mg/kg exhibited competent, potent, and comparable results and it had gained normalcy against the hepatocellular injury caused by CCl₄ during the 7 days treatment period.

Change in body weight, serum albumin, total protein, and assay of marker enzymes on the 8th day [Table 1].

![Table 1: Change in body weight, Serum albumin, total protein and assay of Marker Enzymes on 8th day](image)

<table>
<thead>
<tr>
<th>Group</th>
<th>Change in body wt. (g)</th>
<th>Albumin (g/dL)</th>
<th>Total protein</th>
<th>AST. (IU/l)</th>
<th>ALT. (IU/l)</th>
<th>ALP. (IU/l)</th>
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<tbody>
<tr>
<td>Normal control</td>
<td>10.66±1.28</td>
<td>2.83±0.17</td>
<td>5.70±0.35</td>
<td>75.04±7.23</td>
<td>49.21±4.90</td>
<td>80.30±3.58</td>
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<td>Toxic control</td>
<td>−12.83±1.13c</td>
<td>1.40±0.10c</td>
<td>3.11±0.16c</td>
<td>840.37±28.26c</td>
<td>746.75±18.94c</td>
<td>133.65±3.47c</td>
</tr>
<tr>
<td>Standard</td>
<td>6.83±0.70c</td>
<td>2.71±0.27c</td>
<td>5.09±0.20c</td>
<td>246.23±16.93c</td>
<td>186.38±14.60c</td>
<td>86.49±7.17c</td>
</tr>
<tr>
<td>EEMP₂₅₀</td>
<td>6.16±1.01c</td>
<td>2.61±0.18c</td>
<td>4.96±0.31b</td>
<td>272.77±24.08c</td>
<td>189.15±7.16c</td>
<td>97.15±6.54b</td>
</tr>
</tbody>
</table>

a<0.05, b<0.01, c<0.001

REFERENCES

INTRODUCTION

Aldose reductase (AR) enzyme belongs to aldo keto reductase superfamily and plays important role in diabetes and cardiovascular complications. It reduces glucose to sorbitol and increases the activity of polyol pathway, due to which accumulation of polyol in lens fibers occurs. The polyol causes influx of water and generates osmotic stress which leads to cataracts. The accumulation of sorbitol in cells is the main cause of diabetic complications such as diabetic cataract, retinopathy, neuropathy, and nephropathy. In the present study, an attempt is made for evaluation of antidiabetic potential of extracts of leaves of *Ziziphus nummularia*, family Rhamnaceae using aldose reductase inhibition assay.

MATERIALS AND METHODS

Preparation of extracts

The leaves were Soxhlet extracted with water and 70% methanol. The methanolic extract (ME) was further solvent extracted with water-saturated n-butanol (1:1v/v). The n-butanol phase was separated and treated with 1 M KOH to obtain the raw saponin extract. All the extracts were screened for in vitro aldose reductase inhibitory activity in purified goat lens using Hayman and Kinoshita method in which decrease in NADPH concentration was estimated at 340 nm using ultraviolet-visible spectrophotometer. All the three extracts were found to inhibit AR activity, but at different extent. From dose-response curve, it was found that saponin extract (SE) is more effective AR inhibitor followed by methanolic extract (ME) and aqueous extract (AE). The IC\textsubscript{50} values of SE, ME, and AE are observed to be 24.36 ± 1.76 µg/mL, 68.66 ± 2.82 µg/mL, and 148.70 ± 0.82 µg/mL, respectively. It was observed that SE of *Ziziphus Nummularia* is potently inhibiting the aldose reductase enzyme which contributes major role in the diabetes and its complication.

Key words: Aldose reductase, goat eye lens, NADPH, saponin extract

Address for correspondence:

Kushagra Dubey, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India.

E-mail: kushu0129@gmail.com
of 30 min. The assay was performed in triplicate and decrease in NADPH concentration indicates the aldose reductase activity. Percentage inhibitions and IC\textsubscript{50} value for each extract were calculated from a dose-response curve Table 1.

### RESULTS AND DISCUSSION

Extracts of *Z. nummularia* Linn. leaves potentially inhibit goat lens aldose reductase enzyme with IC\textsubscript{50} value ranging from 24 µg/mL to >100 µg/mL, showed in Table 1. Among the three extracts, saponin extract (SE) showed highest percentage of inhibition (IC\textsubscript{50} [24.36 ±1.76 µg/mL]) followed by methanolic extract [IC\textsubscript{50} (68.66 ± 2.82 µg/mL)] and aqueous extract (IC\textsubscript{50} [148.7 ± 0.82 µg/mL]). The result clearly indicated that the SE is more active than other extracts.

### CONCLUSION

The saponin and methanolic extracts of leaves of *Z. nummularia* Linn. are active toward aldose reductase inhibitory activity. From the result, it can be concluded that the extracts will be helpful in the treatment of cataract and can be used effectively for the management of diabetes complications. In future, the SE can be subjected to isolation, and the isolate can be pharmacologically evaluated for \textit{in vivo} studies.

### REFERENCES

Antitussive Activity of Methanolic Extracts of Ficus exasperata

Sweta S. Koka, G. N. Darwhekar, Vikas Jain

Department of Pharmacognosy, Acropolis Institute of Pharmaceutical Education and Research Indore, Madhya Pradesh, India

Abstract

The present study was conducted to evaluate antitussive activity methanolic extract of Ficus exasperata root. As cough is a natural impulse expulsive defense method of the body, it is the most familiar symptom of respiratory disease. Ammonium hydroxide and sulfur dioxide-induced cough models in mice were used for evaluation of antitussive activity.

Key words: Antitussive activity, Ficus exasperate, Ammonium hydroxide cough induced model

INTRODUCTION

Cough is a common problem that everyone often faces. Cough is an innate reflex expulsive defense system of the body, for clearing excess secretions or mucous or inhaled irritants or toxins or foreign substance in the respiratory tract.[1] Coughing protects the respiratory system by clearance or clear out it voluntarily or involuntarily.[2] As long as cough is obliging in getting free of infectious material with the help of mucous from the airway, it should not be stopped. In these many cases, the cough has a pathological character, and it is necessary to use cough-suppressing agents. Antitussive agents are used mainly to suppress dry and painful coughs.

Ficus exasperate commonly known as Brahm banayan belonging to family Moraceae is also known as natural sandpaper. They are native of India, Africa, and Arabic peninsula. It has been reported that F. exasperata exhibits antiulcerogenic activity, antihypertensive, hypolipidemic, anti-inflammatory, anxiolytic, anticonvulsant, antinociceptive, antipyretic, antimicrobial, insecticidal, and pesticidal activities. The extracts used for above activities are mostly remains uncharacterized, and informations on the active phytoconstituents are also not defined except for phenolics and tannins. F. exasperate is traditionally claimed to be used as decoction by the tribal of Tanzania for the treatment of asthma in treating cough.

MATERIALS AND METHODS

Collection of plant material and preparation of extract

Roots of F. exasperate were collected from Local market, Indore (M.P). 250 g of coarsely powdered roots were subjected to hot percolation method using Soxhelt apparatus, methanol as a solvent. Extract was filtered, concentrated on water bath, dried in vacuum and stored in refrigerator for further experiment.

Experimental animals

Swiss albino mice of either sex (20–30 g) were used in the study. The animals were housed in polypropylene cages under standard conditions (12 h light; 12 h dark cycle; 25 ± 5°C; 35–60% humidity). They were fed with standard pellet diet (Pranav Agro Ltd, Dehradun) and water ad libitum.

Antitussive activity by ammonium hydroxide-induced cough

Swiss albino mice were divided into three groups, each group containing six mice. The control group was treated with distilled water orally, and the positive control was treated with dextromethorphan. The remaining group was treated with the methanolic extract at doses of 500 mg/kg body weight, respectively. Antitussive activity was investigated

Address for correspondence:
Sweta S. Koka, Acropolis Institute of Pharmaceutical Education and Research Indore, Madhya Pradesh, India. E-mail: swetaskoka@acropolis.edu.in
on a classical mouse cough model induced by ammonia liquor. Each mouse was placed in a 300 mL special glass chamber and exposed to 40 μL 25% NH₄OH. The cough frequency produced during 2 min exposure period was counted. The cough frequency and latent period of cough were also recorded. The percentage frequency of cough reflex was calculated by the formula

\[ \text{% Frequency of cough reflex} = (1-T/C) \times 100 \]

Where, \( T = \text{Cough reflex in tested drug treated in mice} \), \( C = \text{Cough reflex in control group treated mice} \).

## RESULTS

The antitussive activity, methanolic extract of root *F. exasperate* was determined using model in which cough was induced by chemicals ammonium hydroxide in mice and result revealed that extract at 500 mg/kg has significant antitussive activity when compared with control and the standard drug dextromethorphan. The decrease in cough frequency was statistically significant \( (P < 0.01) \), when compared to the control group Table 1.

## CONCLUSION

Hence, from this study, it can be concluded that methanol extract of *F. exasperate* produced a significant antitussive activity; thus further studies can be carried out for determination of phytoconstituents responsible for antitussive effect.

## REFERENCES


<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dose (mg/kg)</th>
<th>Frequency of cough (mean±S.E.M.) at time T (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Control</td>
<td>-</td>
<td>77.38±1.58</td>
</tr>
<tr>
<td>Dextromethorphan</td>
<td>10</td>
<td>76.38±1.55</td>
</tr>
<tr>
<td>Meth. Ext of <em>F. exasperate</em></td>
<td>500</td>
<td>77.50±1.51</td>
</tr>
</tbody>
</table>

*F. exasperate: Ficus exasperate*
INTRODUCTION

Tyrosinase is known as a key enzyme in melanin biosynthesis. Melanin formations beneath the skin proceed through a free-radical mechanism. The work has been done mainly on antioxidant activity, anti-inflammatory, anti-hepatotoxic activity, antifungal activity, etc. However, not much work carried on anti-hyperpigmentation activity. As Glycyrrhiza glabra contain glabridin, the ethanolic extract of G. glabra has tyrosinase inhibitory properties.\(^{[1,2]}\)

MATERIALS AND METHODS

The ingredients used in the research work were ethanolic extract of Glycyrrhiza glabra, ethanol, dimethyl sulfoxide (DMSO), Glabridin, 2,2 Diphenyl-1- picrylhyazyl (DPPH), tyrosinase enzyme, L- dopa, ethyl acetate, and phosphate buffer pH 6.8. The ethanol extract of G. glabra and glabridin as standard was spotted on thin-layer chromatography plate (the silica gel G) using the hexane:ethyl acetate (3:2) as mobile phase.

A. The 2.5 mM L-dopa solution.
B. The 50 mM, pH 6.8 phosphate solution.
C. The tyrosinase solution.

Address for correspondence:
Gupta Ruchi, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India.
E-mail: ruchi.gupta@scopeindore.info
the conditions of this exercise. If not used within this period, you will need to extract more enzymes from a fresh potato.

D. The maximum length wave absorbance measurement.
To measure the maximum wavelength, we use 2.4 mL phosphate solution 50 mM (pH 6.8) and 666 μL L-Dopa solution (2.5 mM) pipette into the reaction tube. This solution is then being incubated at room temperature for 10 min. Then, add 184 μL tyrosinase solutions (496 unit/mL) to the reaction tube. This solution is then being incubated again at room temperature for 25 min so that the reaction can occur. The inhibitory activity of tyrosinase was determined by measuring the dopachrome absorbance using the ultraviolet (UV)-vis spectrophotometer in 400–800 nm wavelengths.

E. The measurement of inhibitory activity by IC50 test.

The principal solution was made 500 ppm by weight about 50 mg the ethanol extract of \textit{G. glabra} and dissolve in 100 mL DMSO. Based on principal solution was made in series of 80, 100, 120, 140, and 160 ppm. The IC50 measurement was done to various inhibitory concentrations in percentage inhibitory activity test.

RESULTS AND DISCUSSION

Evaluation of ethanol extract of \textit{G. glabra}

The evaluation that has been done to the ethanolic extract of \textit{G. glabra} is: Organoleptic and phytochemistry. The organoleptic test of ethanol extract of \textit{G. glabra} shows some characteristic such as the thick consistency, the brown color, the aromatic smell, and the acidic taste.

The antioxidant qualitative analysis from ethanol extract of \textit{G. glabra}

To determine the ethanol extract of \textit{G. glabra} consist of antioxidant compound or not, we do the antioxidant qualitative analysis test using the thin-layer chromatography (TLC). The identification result shows that the ethanol extract of \textit{G. glabra} gives spots in TLC plate with different RF. The suspected antioxidant substance is the second spot with 0.36 RF value, because this spot gives the yellow color after being disperse by DPPH solution compound. This spot is the same with glabridin which RF is 0.32.

THE ANTI-HYPERPIGMENTATION ACTIVITY TEST FROM ETHANOL EXTRACT OF \textit{G. GLABRA}

In this reaction, we choose L-dopa because this substrate will directly from dopachrome and can be measure by spectrophotometer UV-visible in 481 wavelength. Based on this research, the formation of dopachrome marked by the color changes, the non-color L-Dopa will change into orange after the tyrosinase enzyme adding, this solution then incubated for 25 min so that the reaction will formed completely, then the formed dopachrome being measure. The maximum absorbance wavelength measurement of dopachrome is the highest peak absorbance in 481 nm. The inhibitory melanine activity measurement from an ethanol extract of \textit{G. glabra} by the determination of IC50 value. The standard solution was made by weight 50 mg of extract then diluted in 100 mL DMSO. Based on this standard solution, we make a series of concentrations: 60; 80; 100; 120; and 120 ppm, then we determined the absorbance, and we calculate the inhibition percentage. The calculation result is then being plot into a curve between extract concentration and inhibitory percentage. The linear regression equation of the curve is \( y = -23.094 + 0.580 \times \) by relation coefficient is 0.9970. Based on the above linear regression equation, the IC50 is 138.076 μg/mL. The IC50 is the amount of extract concentration which inhibit the concentration of tyrosine to 50 %. The IC50 is important to acknowledge so that we can determined the potency of inhibitor to inhibit the tyrosinase enzyme activity.

CONCLUSION

The \textit{G. glabra} has a high antioxidant activity by protecting skin from sunlight’s radiation than can induce the hyperpigmentation abnormality. From the above research showed that an ethanol extract of \textit{G. glabra} has higher inhibitory potential to inhibit the tyrosinase activity because the IC50 was obtained in lower concentration.

REFERENCES

1. Chang TS. Department of Biological Science and Technology. Taiwan: National University Tainan; 2009.
INTRODUCTION

Diabetic wounds are slow, non-healing wounds that can persist for weeks despite adequate and appropriate care. Such wounds are difficult and tough to manage. This wound healing deficits may be caused by impaired blood flow and oxygen release from increased blood sugar. *Prunus domestica* fruit belongs to Family Rosaceae associated with health benefits including improved bone health, cognition, and memory as well as plum fruit possess antioxidant and anti-inflammatory effects.

MATERIALS AND METHODS

Preparation of fruit extract

Pulp was collected from the fruit and juice was screened with the help of muslin cloth. The concentrate was dried, and percentage yield was calculated.

Inductions of diabetes

The animals were injected with a single dose of alloxan monohydrate (120 mg/kg, Sigma) in normal saline (freshly prepared) by intraperitoneal route. Control animals were injected with normal saline. Fasting blood glucose level was measured after 3 days to confirm the diabetic.

Wound healing activity

The wound healing activity was performed using albino rats using two models:

- Excision wound model: Rats were inflicted with excision wounds according to the method of Shivananda *et al.*, 2007.[1]
- Dead space wound model: Dead space wounds were inflicted using the method of Turner 1965.[2]

RESULTS AND DISCUSSION

The excision wound model was carried out to study the topically applied *P. domestica* fruit extract on wound healing and contraction. Increase in the wound healing activity was observed in fruit extract treated rats. On the 5th day, animals of Group II showed greater percentage of wound contraction as compared to Group I. In diabetic animals, percentage of wound contraction was greater in extract treated (Group IV) as compared to diabetic control (Group III). On the 11th day, similar wound contraction was observed. The wound...
contraction results of extract-treated animals were comparable with positive control as shown in Table 1. In excision wound model, animals of Groups II and IV showed a decrease in the epithelialization period and increased percentage of wound contraction when compared with the animals of Groups I, III, and V [Table 1]. On day 11, the extract-treated animals (Groups II and IV) showed wound contraction by 87% compared with 45% in wounds of the control groups (Groups I and III). The wound contraction results of extract-treated animals were comparable with positive control.

The dead space wound model was used to study difference in matrix synthesis between drug-treated and control groups. In diabetic animals, the dry granuloma mass was increased by extract treatments. The normal treated Group II had greater wet/dry ratio than any other group as shown in Table 2. In the dead space wound model [Table 2], the extract-treated animals in Groups II and IV showed significant increases in the dry and wet weight of the granulation tissue. The present study demonstrates that *P. domestica* extract applied topically promotes healing of wound contraction in alloxan-induced diabetic rats where healing is delayed.

### Table 1: Wound healing activity of the *P. domestica* in alloxan-induced diabetic rats using excision wound model

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group I (normal control)</th>
<th>Group II (normal fruit extract treated)</th>
<th>Group III (diabetic control)</th>
<th>Group IV (diabetic fruit extract treated)</th>
<th>Group V (positive control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>wound area (mm²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>220±1.02</td>
<td>222.70±1.764</td>
<td>219.80±1.537</td>
<td>221.50±1.310</td>
<td>220.12±1.770</td>
</tr>
<tr>
<td>Day 5</td>
<td>52.8±1.461 (24)</td>
<td>142.52±2.151** (63)</td>
<td>43.96±0.7638 (20)</td>
<td>135.11±1.352** (60)</td>
<td>149.68±1.726 (67)</td>
</tr>
<tr>
<td>Day 11</td>
<td>94.63±1.256 (43%)</td>
<td>193.74±1.815** (87)</td>
<td>82.33±1.116 (39)</td>
<td>1174.98±1.89**2 (79)</td>
<td>200.30±1.939 (91)</td>
</tr>
</tbody>
</table>

Values are expressed in mean±SEM; one-way ANOVA followed by Dunnet's test. Group I normal saline, Group II normal saline+the extract orally in a dose of 200 mg/kg for 10 days. Group III diabetic controls alloxan (120 mg/kg), and Group IV diabetic treated were given alloxan (120 mg/kg) + extract orally at a dose of 200 mg/kg for 10 days, Group V topically povidone-iodine ointment.

### Table 2: Wound healing activity of the *P. domestica* in alloxan-induced diabetic rats using dead space wound model

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group I (normal control)</th>
<th>Group II (normal fruit extract treated)</th>
<th>Group III (diabetic control)</th>
<th>Group IV (diabetic fruit extract treated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet granulation weight (mg/100 g rat)</td>
<td>99.67±8.168</td>
<td>152.8±17.54</td>
<td>75.17±3.381</td>
<td>103.7±7.116</td>
</tr>
<tr>
<td>Dry granulation weight (mg/100 g rat)</td>
<td>38.17±4.262</td>
<td>35.83±6.134</td>
<td>33.83±0.945</td>
<td>40.5±9.787</td>
</tr>
</tbody>
</table>

Values are expressed in mean±SEM; one-way ANOVA followed by Dunnett's test.

**REFERENCES**

INTRODUCTION

*Malus pumila* is the significant part of human diet. *M. pumila* is rich source of many compounds with proven health benefits. Apple (*Musca domestica*) is one of the most widely cultivated tree fruit. Fruit of many apple cultivars can be stored for an extended period with minimal loss of quality. The application of ethylene action blocker 1-methylcyclopropane (1-MCP). Their primary and secondary metabolites include carbohydrates, organic acids, amino acids, and phenolic compounds. Malic acid is primarily responsible for fruit acidity in apples.

MATERIALS AND METHODS

**Selection and collection of plant**

Plant was selected on the basis of beneficial health effects and its ethanobotanical properties. Fruit is collected from big bazaar Bhopal.

**Extraction of plant**

Fresh apple was taken and peel was off carefully. Peel was air dried in room temperature and grind by mechanical grinder and made a powder. Then, the powder was kept on airtight container and extraction was completed by the cold maceration method.

**Phytochemical testing**

Phytochemical testing was performed to identify presence or absence of different bioactive constituents by a standard method trans and evans (year).

**Test for carbohydrate**

- The following tests perform by Molisch test, Fehling test, and Benedict test.
- Test for protein and amino acids: The following tests perform by biuret test and ninhydrin test.
- Test for glycosides: The following tests perform by Borntrager’s test and Keller Killiani test.
- Test for alkaloids: The following tests perform by Mayer’s test, Hager’s Test, and Wagner’s test.

**Tests for triterpenoids and steroids**

*Salskowaski reaction*

Chloroform shaken with equal volumes of concentrated sulphuric acid and layers allowed to separate by standing, the chloroform layer turns red.

*Libermann-Burchard’s test*

Dissolve one or two crystals of cholesterol in dry chloroform in a dry test tube. Add several drops of acetic anhydride and then 2 drops of conc. H2SO4 and mix carefully.

**Key words:** *Malus Pumilla Peel, Qualitative, Qualitative tests*

**Abstract**

Importance of medical plants is known to all from the ancient time. People tend to prefer household remedies for the cure of many diseases. Thus, here to investigate the importance of bioactive components present in the extract of *Malus pumila* peel. The present study was designed to investigate the phytochemical and antioxidant activity of *M. pumila* peel, family Rosaceae, was studied using various qualitative and quantitative phytochemical tests and various antioxidant activities. Methanolic extract was found more active than aqueous extract; the methanolic extract of *M. pumila* peel (*M. pumila*) shows the presence of carbohydrate, amino acids, protein, phenolic compound, steroids, etc.

**Address for correspondence:**

Deepa Varandani, Pinnacle Biomedical Research Institute, Bhopal, Madhya Pradesh, India.

E-mail: deepani44@gmail.com
Quantitative test

**Total phenol contents (TPC)**

TPC was estimated according to the method of Ainsworth et al., 2007, spectrophotometrically. The following tests perform by Folin–Ciocalteu reagent.[2]

**Total flavonoid content (TFC) estimation**

TFC estimation was determined according to the procedure of Zhishen et al., distilled water, 5% NaNO2 solution, 10% AlCl3 solution, and adding 2 mL of 4% NaOH.[3]

**RESULTS**

Phytochemical estimation

<table>
<thead>
<tr>
<th>Phytochemical constituents</th>
<th>Methanolic extract</th>
<th>Aqueous extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Protein</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Glycosides</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Saponins</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Flavanoids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Triterpenoides</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Tannins and phenolics</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Quantitative photochemical investigation: TFC and TPC

**Reducing power assay**

The extract was prepared as mg/ml as stock solution. From the stock solution various concentrations in µg/ml were prepared. Add 0.5 ml of different concentrations of sample with 0.5 ml of phosphate buffer (0.2 M, pH 6.6) and 0.5 ml of potassium ferricyanide (0.5 ml, 1% W/V). The Reaction mixture was incubated at 50° C for 20 min. After cooling, added 1.5 ml of trichloroacetic acid solution (10% W/V) to terminate the reaction. After that added 0.5 ml ferric chloride (0.1% W/V) and absorbance was measured at 700 nm. The curve was plotted absorbance versus concentration.

**DISCUSSION**

In the present study, it is revealed that *M. pumilia* has so many compounds such as carbohydrate, amino acids, fiber, glycoside, and steroids. It has antioxidant activity. It contains phenolic compound in the qt. of 0.120 mg/g equivalent to gallic acid and flavonoid compound in the qt. of 0.093 mg/g equivalent to gallic acid. According to the results of antioxidant assays, in the DPPH assay aqueous extract has the significant difference with ascorbic acid, i.e., it has IC50 value 78.65 and 11.54, whereas methanolic extract’s IC50 value is 146.88.

**CONCLUSION**

Bioactivity-guided by fractionation of red delicious apple peels was used to determine the chemical identity of bioactive constituents, which shows antioxidant activity. Compounds such as carbohydrates, proteins, amino acids, and alkaloids triterpenoids are present. It is used to control many diseases.

**REFERENCES**

INTRODUCTION

Hair is one of the external barometers of internal body conditions. Hair grows from primary follicles. There are approximately 5 million total body hair follicles, of which 100,000 to 150,000 are scalp follicles.\(^1\) The main problems associated with hairs are pigmentation (fading), dandruff and falling of hairs (shedding), and balding.\(^2\)

MATERIALS AND METHODS

Plant material

Fresh leaves of *Hibiscus* were collected in the month of September from the Herbal Garden premises of Smriti College of Pharmaceutical Education, India. The collected leaves were dried in the shade, powdered to a coarse consistency and stored in an airtight container at room temperature (35°C).

Preparation of hibiscus leaves extract

Hibiscus leaves were washed under the running water to remove contaminants; it was dried under shade, coarsely powdered and extracted by cold maceration separately by agitation using 70% methanol for 5 days. The marc was squeezed out and filtered off. The combined filtrate was concentrated by allowing it to be evaporated from the Petri dish.

Preparation of black pepper oil

Black pepper powder was purchased from local market of Indore. This powder in required quantity was boiled with freshly purchased coconut oil with continuous stirring at a constant temperature; until the drug was completely extracted in the oil. The oil was then filtered through a muslin cloth and stored [Table 1].

Preparation of herbal shampoo

Coconut oil containing active principles of black pepper, olive oil, and castor oil was saponified with potassium hydroxide in a conical flask. After complete saponification, glycerin was incorporated with stirring followed by mixing of *Hibiscus* leaves extract. Ethyl alcohol, and methylparaben used as preservative and jasmine oil was used for masking the pungent smell of extract.

Evaluation of formulated shampoo

• Physical appearance/visual inspection
  The formulated shampoo was evaluated for the color,
transparency, odor, visual appearance, and presence of foreign particles.

- Determination of pH
  The pH of the 10% v/v shampoo solution in distilled water was determined using pH tester at room temperature.

- Determination of percentage of solid contents
  The liquid portion of the shampoo was evaporated by placing the dish on hot plate. The weight and percentage of the solid content of shampoo left after complete drying were calculated.

- Foaming ability and foam stability
  50 mL of the 1% formulated shampoo solution was placed into a 250 mL graduated cylinder, covered with one hand and shaken for 10 times. After 1 min of shaking, the total volume of the foam content was recorded.

- Measurement of surface tension
  Surface tension of 10% diluted shampoo formulation was measured by drop weight method using stalagmometer at room temperature.

- Viscosity profile
  The viscosity profile of the shampoo formulation was measured using Brookfield viscometer at 25°C.

- Dirt dispersion
  Two drops of shampoo were added in a large test tube containing 10 mL of distilled water. 1 drop of India ink was added; the test tube was stoppered and shaken it 10 times.

- Cleaning action
  5 g of wool yarn was placed in grease, after that it was placed in 200 mL of water containing 1 g of shampoo in a flask. The flask was shaken for 4 min at the rate of 50 times a minute. The amount of grease removed was calculated.

- Skin irritation test
  The solution of prepared shampoo was applied on skin and kept for 5 min and observed for redness of skin and irritation.

- Stability study
  The stability study was carried out for the prepared shampoo at standard room temperature of 25–30°C and at 4°C for 2 weeks. Several parameters such as physical appearance, odor, and color of the prepared shampoo were noticed.

### RESULTS AND DISCUSSIONS

The herbal shampoo with Black Pepper and Hibiscus Extract was evaluated and the results are given in Table 2.

### CONCLUSION

The present study was aimed to formulate an herbal shampoo containing Hibiscus leaves extract and black pepper. A number of tests were performed to determine the physicochemical properties of the formulated herbal shampoo. All the ingredients used to formulate, the shampoo was found safer than commercial shampoos and the physicochemical evaluation showed ideal results, but further research is required to detect its hair growth promotion effects.

### REFERENCES

Solubility Enhancement of Valsartan by Solid Dispersion Technique

Harshvardhan Chouhan, Madhavi Kasturi, Neelesh Malviya
Department of Pharmaceutics, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

Abstract

Solubility is an important parameter which affects drug absorption as well as its therapeutic efficacy. Drugs with low aqueous solubility always present one of the major confronts for better absorption of those drugs. The main aim of this study was enhancement of solubility of drug valsartan by the use of solid dispersion technique. In this study, solid dispersions of valsartan were prepared using synthetic hydrophilic polymers such as PEG-4000, PEG-6000, and poloxamer-407 by kneading technique. Solid dispersion technique may also help to improve bioavailability.

Key words: Solid dispersion, solubility enhancement, valsartan

INTRODUCTION

Poor aqueous solubility and bioavailability were the two major problems that hinder drug absorption after administration and faced by various pharmaceutical companies.[1] Solid dispersion is one of the most possible techniques for enhancement of solubility, dissolution rate as well as overall absorption of several water-insoluble drugs. There was tremendous improvement in solubility and bioavailability of poorly soluble drug by use of hydrophilic polymers such as PEG-4000, PEG-6000, and poloxamer-407. Valsartan was selected as a model drug in present work because it has very low aqueous solubility (0.021 mg/mL) and bioavailability (25%). Valsartan is an angiotensin 2 receptor blocker and used widely in treatment of hypertension. The solid dispersions of valsartan were prepared by the use of selected polymers such as PEG-4000, PEG-6000, and poloxamer-407 using kneading technique.

MATERIALS AND METHODS

Valsartan was obtained from hetero drugs, Hyderabad, India. All other chemicals used were of analytical grade.

EXPERIMENTAL METHODS

Preparation of valsartan solid dispersions by kneading technique:

Valsartan and polymers were weighed accurately into mortar and pestle. Then, 5 mL of methanol was added to mixture and mixed for 45 min until thick paste was obtained. It was further dried at room temperature, passed through sieve no # 44 and stored in polybags [Table 1].

Saturation solubility studies:
Studies were carried out using shake flask method. Excess quantities of solid dispersions were added to 10 mL distilled water in 25 mL conical flasks.[2] The samples were shaken for 24 h and then filtered. Filtrate was analyzed for drug content at 250 nm by ultraviolet spectrophotometer.

Rheological properties

Bulk density, tapped density, compressibility index, Hausner ratio, and angle of repose.

Percent practical yield: Calculated by considering theoretical and practical yield.

Drug content analysis

Solid dispersion equivalent to 40 mg of valsartan was weighed accurately and dissolved in 100 mL of methanol and analyzed for drug content at 250 nm using ultraviolet (UV) spectrophotometer.

Address for correspondence:
Harshvardhan Chouhan, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India. E-mail: harshcures1992@gmail.com
Table 1: Formulation of drug using different polymeric carriers

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>SD 01</th>
<th>SD 02</th>
<th>SD 03</th>
<th>SD 04</th>
<th>SD 05</th>
<th>SD 06</th>
<th>SD 07</th>
<th>SD 08</th>
<th>SD 09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Poloxamer-407</td>
<td>40</td>
<td>200</td>
<td>400</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>PEG-4000</td>
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<td>-</td>
<td>40</td>
<td>200</td>
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<tr>
<td>PEG-6000</td>
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<td>-</td>
<td>-</td>
<td>40</td>
<td>200</td>
<td>400</td>
</tr>
</tbody>
</table>

Table 2: Evaluation parameters of valsartan solid dispersions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SD 01</th>
<th>SD 02</th>
<th>SD 03</th>
<th>SD 04</th>
<th>SD 05</th>
<th>SD 06</th>
<th>SD 07</th>
<th>SD 08</th>
<th>SD 09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water solubility</td>
<td>0.082</td>
<td>0.095</td>
<td>0.103</td>
<td>0.107</td>
<td>0.116</td>
<td>0.128</td>
<td>0.143</td>
<td>0.166</td>
<td>0.179</td>
</tr>
<tr>
<td>Solubility enhancement</td>
<td>3.9</td>
<td>4.5</td>
<td>4.9</td>
<td>5.1</td>
<td>5.5</td>
<td>6.1</td>
<td>6.8</td>
<td>7.9</td>
<td>8.5</td>
</tr>
<tr>
<td>% Practical yield</td>
<td>95.5</td>
<td>96.2</td>
<td>96.2</td>
<td>94.9</td>
<td>96.7</td>
<td>95.8</td>
<td>96.3</td>
<td>96.2</td>
<td>97.7</td>
</tr>
<tr>
<td>Drug content</td>
<td>95.5</td>
<td>96.6</td>
<td>96.9</td>
<td>94.1</td>
<td>97.2</td>
<td>97.7</td>
<td>97.5</td>
<td>97.6</td>
<td>98.8</td>
</tr>
<tr>
<td>Angle of repose (θ)</td>
<td>27</td>
<td>27</td>
<td>24</td>
<td>28</td>
<td>24</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>Bulk density</td>
<td>0.74</td>
<td>0.72</td>
<td>0.71</td>
<td>0.74</td>
<td>0.72</td>
<td>0.7</td>
<td>0.69</td>
<td>0.71</td>
<td>0.71</td>
</tr>
<tr>
<td>Tapped density</td>
<td>0.85</td>
<td>0.83</td>
<td>0.81</td>
<td>0.84</td>
<td>0.83</td>
<td>0.79</td>
<td>0.76</td>
<td>0.78</td>
<td>0.79</td>
</tr>
<tr>
<td>Carr's index</td>
<td>14.9</td>
<td>15.3</td>
<td>14.08</td>
<td>15.3</td>
<td>15.3</td>
<td>12.9</td>
<td>10.14</td>
<td>9.85</td>
<td>11.2</td>
</tr>
<tr>
<td>Hausner's ratio</td>
<td>1.15</td>
<td>1.153</td>
<td>1.14</td>
<td>1.14</td>
<td>1.15</td>
<td>1.13</td>
<td>1.1</td>
<td>1.1</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Figure 1: *In vitro* release profile of solid dispersion

Figure 2: Fourier-transform infrared and differential scanning calorimetry results of valsartan pure drug and solid dispersions.
**In vitro release studies**

In vitro release studies of solid dispersions were performed by USP Type 2 apparatus using 900 ml of phosphate buffer (pH-6.8) at 37 ± 0.5°C with 50 rpm speed. Samples were withdrawn periodically, filtered and analyzed for drug content at 250 nm using UV.[2]

**DRUG-EXCIPIENT INTERACTION STUDIES OF OPTIMIZED VALSARTAN SOLID DISPERSIONS**

Optimized valsartan solid dispersions were characterized by Fourier-transform infrared (FTIR) and differential scanning calorimetry (DSC) analysis.

**RESULTS AND DISCUSSION**

Solid dispersions of valsartan were evaluated and the results are given in Table 2.

**CONCLUSION**

Successfully solid dispersions of valsartan were prepared with enhanced solubility in water.

**REFERENCES**

INTRODUCTION

Fast dissolving tablets (FDTs) are solid dosage forms containing medicinal substance or active ingredient which disintegrate rapidly usually within a matter of seconds when placed on the tongue. The absorption of drug starts from mouth, pharynx, and esophagus as the saliva pass down toward the stomach. The objective of preparing FDT of venlafaxine is to avoid first-pass metabolism by allowing pre-gastric drug absorption thus reducing dose of drug. This gives possibility of improved bioavailability due to rapid absorption and faster onset of action. Venlafaxine is an antidepressant drug that comes under the class serotonin norepinephrine reuptake inhibitor. Venlafaxine is indicated for the treatment of depressive illness including depression accompanied by anxiety and panic attacks. Coprocessing is a novel concept of two or more excipients interacting at sub-particle level which serves the excipient granules with superior properties as compared with the physical mixture of the excipients or individual components.

MATERIALS AND METHODS

Venlafaxine hydrochloride, crospovidone (CP), sodium starch glycolate (SSG), microcrystalline cellulose (MCC), magnesium stearate, mannitol, ethanol, and talc were used.

EXPERIMENTAL METHODS

FDTs of venlafaxine hydrochloride were prepared by direct compression method using coprocessed superdisintegrants. Pre-compression flow properties of granules: The powder blends of all the six formulations were studied for their granule properties such as angle of repose, bulk density, tapped density, compressibility index, and Hausner’s ratio. Post-compression parameters: All the formulated tablets were evaluated for post-compression parameters such as thickness, friability, hardness, weight variation, drug content, disintegration time, wetting time, and in vitro drug release. All the evaluation parameters were found to be within limits.

RESULTS AND DISCUSSION

The results of all parameters were reported in Tables 2 and 3.

Address for correspondence:
Vishakha Chauhan, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India.
E-mail: vishakha13072016@gmail.com
Table 1: Composition of venlafaxine hydrochloride FDTs

<table>
<thead>
<tr>
<th>Ingredients (mg)</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venlafaxine HCL</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>SSG:CP</td>
<td>10 (1:1)</td>
<td>10 (1:2)</td>
<td>10 (1:3)</td>
<td>10 (2:1)</td>
<td>10 (3:1)</td>
<td>10 (1:1)</td>
</tr>
<tr>
<td>MCC</td>
<td>48</td>
<td>48</td>
<td>48</td>
<td>48</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>Mg. stearate</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Mannitol</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Talc</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

F1-F5 coprocessed and F6 - physical mixture, FDTs: Fast dissolving tablets

Table 2: Pre-compression studies of venlafaxine hydrochloride FDTs

<table>
<thead>
<tr>
<th>Parameters</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle of repose (θ)</td>
<td>22.73</td>
<td>24.08</td>
<td>21.85</td>
<td>21.70</td>
<td>18.88</td>
<td>23.12.0</td>
</tr>
<tr>
<td>Bulk density (g/cm³)</td>
<td>0.46</td>
<td>0.44</td>
<td>0.45</td>
<td>0.50</td>
<td>0.48</td>
<td>0.51</td>
</tr>
<tr>
<td>Tapped density (g/cm³)</td>
<td>0.60</td>
<td>0.55</td>
<td>0.54</td>
<td>0.61</td>
<td>0.55</td>
<td>0.63</td>
</tr>
<tr>
<td>Carr’s index (%)</td>
<td>23.3</td>
<td>20.0</td>
<td>16.6</td>
<td>18.0</td>
<td>12.7</td>
<td>23.5</td>
</tr>
<tr>
<td>Hausner’s ratio</td>
<td>1.30</td>
<td>1.25</td>
<td>1.20</td>
<td>1.22</td>
<td>1.14</td>
<td>1.23</td>
</tr>
</tbody>
</table>

FDTs: Fast dissolving tablets

Table 3: Post-compression studies of venlafaxine hydrochloride FDTs

<table>
<thead>
<tr>
<th>Parameters</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness (mm)</td>
<td>2.50</td>
<td>2.52</td>
<td>2.51</td>
<td>2.48</td>
<td>2.49</td>
<td>2.53</td>
</tr>
<tr>
<td>Hardness (kg/cm²)</td>
<td>2.9</td>
<td>3.0</td>
<td>2.7</td>
<td>2.9</td>
<td>2.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Friability (%)</td>
<td>0.89</td>
<td>0.92</td>
<td>0.85</td>
<td>0.87</td>
<td>0.80</td>
<td>0.84</td>
</tr>
<tr>
<td>Weight variation (mg)</td>
<td>198.9</td>
<td>194.0</td>
<td>195.0</td>
<td>197.2</td>
<td>199.6</td>
<td>197.0</td>
</tr>
<tr>
<td>Wetting time (s)</td>
<td>70</td>
<td>47</td>
<td>38</td>
<td>51</td>
<td>35</td>
<td>52</td>
</tr>
<tr>
<td>Drug content (%)</td>
<td>98.63</td>
<td>99.57</td>
<td>99.75</td>
<td>99.71</td>
<td>99.80</td>
<td>99.39</td>
</tr>
<tr>
<td>Disintegration time</td>
<td>58</td>
<td>42</td>
<td>33</td>
<td>40</td>
<td>30</td>
<td>45</td>
</tr>
</tbody>
</table>

FDTs: Fast dissolving tablets

**In vitro drug release** [Figure 1]

![Figure 1: In vitro drug release studies of venlafaxine hydrochloride fast dissolving tablets](image)

**CONCLUSION**

Finally, venlafaxine hydrochloride FDTs were prepared.

**REFERENCES**


Formulation and Evaluation of Foam Bath with Antifungal Potential

Nidhi Phase, Deepesh Rajput, Mr. Ankit Mangal

Smriti College of Pharmaceutical Education, Indore (M.P.), Nidhi Phase, Deepesh Rajput, Ankit Mangal, Tahir Nizami

Abstract

A foam bath is a filled bathtub with a layer of surfactant foam on the surface of the water and consequently also the surfactant product used to produce the foam. Foam bath preparations may be in the form of liquid (or gel) with water, or as solids in the form of powders, grains, or tablets. The present investigation was carried out to formulate the medicated foam bath powder preparation based on traditional knowledge and to develop a few parameters for quality and purity of foam bath powder. The formulated medicated foam bath powder preparations were evaluated for the organoleptic, general powder characteristics, and physiochemical studies. They were also evaluated for their different properties, cleaning action foaming capacity, and pH, etc., from the given studies it is concluded all the three foam bath powder formulations are showing good results and contains all the desired properties.

Key words: Antifungal, foam bath, neem

The human skin is the outer covering of the body. In human, it is the largest organ of the integumentary system. The skin has up to seven layers of ectodermal tissue and guards the underlying muscles, bones, ligaments, and internal organs. For the average adult human, the skin has a surface area of between 1.5 and 2.0 m² (16.1–21.5 sq ft.). Skin is composed of three primary layers: The epidermis, the dermis, and the hypodermis. Fungal infections affect the outer layers of the skin, nails, and hair. In contrary to many of the other infections affecting the outer organ system in humans, the fungi may cause dermatological condition that does not involve tissue invasion. They may be caused by yeast dermatophytes, such as epidermophytons, microsporum, and trichophyton. A foam bath is a filled bathtub with a layer of surfactant foam on the surface of the water and consequently also the surfactant product used to produce the foam. Foam bath preparations may be in the form of liquid (or gel) with water, or as solids in the form of powders, grains, or tablets. Addition of essential oils such as lavender, vanilla will encourage natural relaxation. Foam bath benefits in maintain a healthy and glowing skin.

All the ingredients were weighed accurately using electronic balance. They were triturated in mortar pestle by geometric dilution method. Perfume was added in sufficient quantity to produce desired color. The formulation was then passed from sieve number 44 [Table 1].

RESULTS AND DISCUSSION

The results of all parameters were reported in Tables 2,3,4, and 5.

CONCLUSION

The different formulations of foam bath powder were prepared. The formulated medicated foam bath powder preparations were evaluated for the organoleptic, general powder characteristics, and physiochemical studies. They were also evaluated for their different properties, cleaning action foaming capacity, and pH, etc., from the given studies it is concluded all the three foam bath powder formulations are showing promising results and contains all the desired properties.

Address for correspondence:
Ankit Mangal, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India.
E-mail: ankitmangal75@gmail.com
Table 1: Composition of foam bath

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Formulation No. 1 (g)</th>
<th>Formulation No. 2 (g)</th>
<th>Formulation No. 3 (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium laryl sulfate</td>
<td>29</td>
<td>27</td>
<td>25</td>
</tr>
<tr>
<td>Neem</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Zinc oxide</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Corn starch</td>
<td>-</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Citric acid</td>
<td>pH up to 6</td>
<td>pH up to 6</td>
<td>pH up to 6</td>
</tr>
<tr>
<td>Coloring agent</td>
<td>q.s.</td>
<td>q.s.</td>
<td>q.s.</td>
</tr>
<tr>
<td>Perfume</td>
<td>q.s.</td>
<td>q.s.</td>
<td>q.s.</td>
</tr>
</tbody>
</table>

Table 2: Physical evaluation of foam bath powder

<table>
<thead>
<tr>
<th>Physical evaluation</th>
<th>Formulation No. 1</th>
<th>Formulation No. 2</th>
<th>Formulation No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Faint pink</td>
<td>Faint pink</td>
<td>Faint pink</td>
</tr>
<tr>
<td>Odor</td>
<td>Pleasant</td>
<td>Pleasant</td>
<td>Pleasant</td>
</tr>
<tr>
<td>Texture</td>
<td>Fine and smooth</td>
<td>Fine and smooth</td>
<td>Fine and smooth</td>
</tr>
</tbody>
</table>

Table 3: General characterization of foam bath powder

<table>
<thead>
<tr>
<th>General characteristics</th>
<th>Formulation No. 1</th>
<th>Formulation No. 2</th>
<th>Formulation No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk density</td>
<td>0.503</td>
<td>0.521</td>
<td>0.483</td>
</tr>
<tr>
<td>Tapped density</td>
<td>0.699</td>
<td>0.968</td>
<td>0.846</td>
</tr>
<tr>
<td>Angle of repose</td>
<td>25.65</td>
<td>53.67</td>
<td>46.30</td>
</tr>
</tbody>
</table>

Table 4: Different evaluation parameter of foam bath powder

<table>
<thead>
<tr>
<th>Evaluation parameter</th>
<th>Formulation No. 1</th>
<th>Formulation No. 2</th>
<th>Formulation No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6</td>
<td>5.96</td>
<td>5.67</td>
</tr>
<tr>
<td>Skin irritation</td>
<td>No irritation</td>
<td>No irritation</td>
<td>No irritation</td>
</tr>
<tr>
<td>Cleansing action (%)</td>
<td>21.83</td>
<td>27.05</td>
<td>38.58</td>
</tr>
</tbody>
</table>

Table 5: Foaming stability of foam bath powder

<table>
<thead>
<tr>
<th>Formulation No. 1 (mL)</th>
<th>Formulation No. 2 (mL)</th>
<th>Formulation No. 3 (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>98</td>
<td>95</td>
</tr>
<tr>
<td>95</td>
<td>97</td>
<td>93</td>
</tr>
<tr>
<td>95</td>
<td>97</td>
<td>93</td>
</tr>
<tr>
<td>94</td>
<td>98</td>
<td>92</td>
</tr>
<tr>
<td>94</td>
<td>96</td>
<td>91</td>
</tr>
</tbody>
</table>

REFERENCES

INTRODUCTION

Albendazole is a benzimidazole conventional which is used for the treatment of a diversity of parasitic worm infestations. It is a broad-spectrum antihelminthic and is efficacious antagonistic toward roundworms, tapeworms, and flukes. These are novel types of tablets that dissolve/disintegrate/disperse in saliva within few seconds without water.

EXPERIMENTAL METHODS

- Formulation of tablets
- Formulation of tablets

Fast dissolving tablets of ABZ were prepared using direct compression method incorporating microcrystalline cellulose (MCC) and sodium alginate (SA) as disintegrants and cross carmellose sodium (CCS) and sodium starch glycolate (SSG) as superdisintegrants. The ABZ solid dispersion equivalent to 200 mg, mannitol, polyvinylpyrrolidone K-30(PVP K-30), and aspartame were mixed thoroughly in glass mortar using a pestle. Disintegrants or superdisintegrants were incorporated in the powder mixture according to each formulation in the tablets and finally magnesium stearates were added. The whole mixture will be passed through Sieve No. 60 twice. Tablets will be prepared using tablet machine [Table 1].

RESULTS AND DISCUSSION

- Evaluation of tablets

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>F1 (in mg)</th>
<th>F2 (in mg)</th>
<th>F3 (in mg)</th>
<th>F4 (in mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid dispersion of ABZ equivalent to</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>PVP K-30</td>
<td>33</td>
<td>33</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Magnesium stearate</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Mannitol</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Aspartame</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Sodium alginate</td>
<td>55</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Microcrystalline cellulose</td>
<td>-</td>
<td>55</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sodium starch glycolate</td>
<td>-</td>
<td>-</td>
<td>55</td>
<td>-</td>
</tr>
<tr>
<td>Cross carmellose sodium</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>55</td>
</tr>
</tbody>
</table>

Address for correspondence:
Nikita Sohaney, Modern Institutes of Pharmaceutical Sciences Indore, Madhya Pradesh, India.
E-mail: Nikita.sohaney@gmail.com
CONCLUSION

In this work, from the observation at the time of measurement of dispersion time and disintegration time, it was proved that sodium starch glycolate (SSG) increases the solubility and thus decreases the dispersion time disintegration time.

REFERENCES


Table 2: Evaluation of solid dispersion

<table>
<thead>
<tr>
<th>F</th>
<th>Dissolution studies drug release (in 90 min) (µg/mL)</th>
<th>First-order</th>
<th>Zero-order</th>
<th>Higuchi model</th>
<th>Korsmeyer-Peppas model</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>129.69</td>
<td>0.936</td>
<td>0.856</td>
<td>0.770</td>
<td>0.318</td>
</tr>
<tr>
<td>F2</td>
<td>86.3</td>
<td>0.929</td>
<td>0.947</td>
<td>0.837</td>
<td>0.749</td>
</tr>
<tr>
<td>F3</td>
<td>78.6</td>
<td>0.916</td>
<td>0.954</td>
<td>0.827</td>
<td>0.728</td>
</tr>
<tr>
<td>F4</td>
<td>249.38</td>
<td>0.991</td>
<td>0.969</td>
<td>0.886</td>
<td>0.847</td>
</tr>
</tbody>
</table>

Table 3: Evaluation parameter of tablets

<table>
<thead>
<tr>
<th>F</th>
<th>Hardness</th>
<th>Weight variation</th>
<th>Friability</th>
<th>Disintegration time</th>
<th>Wetting time</th>
<th>Content of uniformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>3.5±0.5</td>
<td>3.5±1.5</td>
<td>0.96±0.5</td>
<td>4.85±1.50</td>
<td>4.15±0.25</td>
<td>96.28±0.75</td>
</tr>
<tr>
<td>F2</td>
<td>3.8±0.5</td>
<td>2.9±1.4</td>
<td>0.68±0.15</td>
<td>5.31±0.30</td>
<td>3.1±0.25</td>
<td>95.81±0.37</td>
</tr>
<tr>
<td>F3</td>
<td>2.3±0.05</td>
<td>1.2±0.74</td>
<td>0.59±0.1</td>
<td>1.45±0.25</td>
<td>2.3±0.05</td>
<td>99.97±0.89</td>
</tr>
<tr>
<td>F4</td>
<td>4.2±2.05</td>
<td>2.4±1.30</td>
<td>0.72±0.2</td>
<td>2.96±1.60</td>
<td>3.4±1.9</td>
<td>94.64±0.29</td>
</tr>
</tbody>
</table>
INTRODUCTION

Transdermal drug delivery system is the system in which the delivery of the active ingredients of the drug occurs by means of skin. Several important advantages of transdermal drug delivery are limitation of hepatic first-pass metabolism, enhancement of therapeutic efficiency and maintenance of steady plasma level of the drug. Diabetes mellitus is a chronic metabolic disorder characterized by high blood glucose concentration hyperglycemia caused by insulin deficiency, often combined with insulin resistance. Glibenclamide is an oral sulfonylurea hypoglycemic agent.

MATERIALS AND METHODS

Preparation of transdermal film

Solvent casting technique was employed in the present work for the preparation of drug films.

Solution of plain chitosan and chitosan/hydroxypropyl methylcellulose (HPMC) blend was prepared by dissolving the polymer in 1.0% w/v acetic acid solution, and the solution of HPMC was prepared by dissolving in a mixture of water and ethanol (8:2), respectively. To the above polymeric solution 30% w/w (with respect to dry weight of polymer) of DBT and was added. DBT was used as a plasticizer in the preparation of films. 10 mg of glibenclamide was added and stirred for 30 min and penetration enhancer was added. Drug-containing polymeric solution (10 mL) was poured into a Petri dish, and kept in an oven at 40°C for complete drying. The dried films were removed from the Petri dish and stored in desiccators until use.

Table 1: Composition of transdermal patch

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug (mg)</td>
<td>F1  F2  F3  F4  F5  F6</td>
</tr>
<tr>
<td>Chitosan % (w/v)</td>
<td>25  25  25  50  50  50</td>
</tr>
<tr>
<td>HPMC % (w/v)</td>
<td>25  50  75  25  50  75</td>
</tr>
<tr>
<td>DBT % w/v</td>
<td>30  30  30  30  30  30</td>
</tr>
<tr>
<td>Oleic acid</td>
<td>5   5   5   5   5   5</td>
</tr>
<tr>
<td>Ethanol:water</td>
<td>8:2 8:2 8:2 8:2 8:2 8:2</td>
</tr>
</tbody>
</table>

HPMC: Hydroxypropyl methylcellulose

Address for correspondence:
Verma Poojashree, Modern Institute of Pharmaceutical Sciences, Indore, Madhya Pradesh, India.
E-mail: Pooja11.pharma@gmail.com
RESULTS AND DISCUSSION

On the basis of drug release study, the formulation F4 was found to be optimum. Transdermal preparation solvent casting method was most prominent method to obtained clear, smooth and with superior thickness. Based on drug content and drug release of various batch optimized batch was found to be F4.

Transdermal patches of glibenclamide were prepared using polymer, such as HPMC and Chitosan. The patches were transparent, smooth, and flexible. The optimized batch was selected on the base of drug in vitro drug release study by diffusion study.

REFERENCES

INTRODUCTION

Fast dissolving tablets are advantageous in the way they are ideal for all types of people, including those who have swallowing difficulties, pediatric, geriatric, and bedridden patients, and also traveler friendly as they do not require water to swallow the dosage form. Oral disintegrating tablets (ODTs) also known as fast dissolving tablets (FDTs) are solid single-unit dosage forms when placed in mouth disperse/dissolve in the saliva without any need of water and provides quick onset of action by the use of superdisintegrants. Coprocessing is novel technique used in the formation of coprocessed superdisintegrants such as crospovidone, croscarmellose sodium, and sodium starch glycolate with superior properties compared to normal physical mixing.[1] The rationale to choose valsartan for ODT formulation is that it has very low systemic availability of 25%, which is reduced to about 15% by food. Valsartan is an angiotensin II receptor antagonist used in the management of hypertension.[2]

MATERIALS AND METHODS

Valsartan was obtained as gift sample from hetero drugs, Hyderabad. All other chemicals and excipients used were of analytical grade.

EXPERIMENTAL METHODS

Formulation of oral disintegrating tablets of valsartan

ODTs of valsartan were prepared by direct compression technique. Valsartan, mannitol, and coprocessed superdisintegrants must be passed through sieve # 60. Orange flavor, magnesium stearate and talc previously passed through sieve # 60 were then added to above blend and finally compressed using rotary tablet compression machine [Table 1].

Evaluation of pre-compression parameters of bulk powder

Pre-compression parameters or rheological properties of bulk powder are evaluated such as angle of repose, bulk density, tapped density, compressibility index, and Hausner’s ratio

Evaluation of oral disintegrating tablets of valsartan (post-compression parameters)

The post-compression evaluation parameters include determination of weight variation, thickness, hardness, friability, wetting time, water absorption ratio, content uniformity, disintegration time, and in vitro release studies of valsartan ODT tablets.

Address for correspondence:
Neha Amera, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India
E-mail: sneharajput9@gmail.com
RESULTS AND DISCUSSION

The results of pre- and post-compression parameters are given in Table 2.

In vitro release studies

The results of in vitro dissolution reveal that F6 formulation showed maximum cumulative percent release of 94.7% within 12 min.

### Table 1: Composition of oral disintegrating tablets of valsartan

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valsartan (mg)</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Microcrystalline cellulose (mg)</td>
<td>80</td>
<td>85</td>
<td>90</td>
<td>95</td>
<td>100</td>
<td>105</td>
</tr>
<tr>
<td>Sodium starch glycolate (mg)</td>
<td>20</td>
<td>19</td>
<td>18</td>
<td>17</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Crospovidone (mg)</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>Mannitol (mg)</td>
<td>105</td>
<td>100</td>
<td>95</td>
<td>90</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>Mint flavor (mg)</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Magnesium stearate (mg)</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Talc (mg)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total weight (mg)</td>
<td>265</td>
<td>265</td>
<td>265</td>
<td>265</td>
<td>265</td>
<td>265</td>
</tr>
</tbody>
</table>

### Table 2: Pre- and post- compression studies of valsartan ODT formulations

<table>
<thead>
<tr>
<th>Parameters</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-compression parameters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk density</td>
<td>0.4</td>
<td>0.41</td>
<td>0.41</td>
<td>0.42</td>
<td>0.43</td>
<td>0.44</td>
</tr>
<tr>
<td>Tapped density</td>
<td>0.51</td>
<td>0.55</td>
<td>0.56</td>
<td>0.58</td>
<td>0.62</td>
<td>0.66</td>
</tr>
<tr>
<td>Carr’s index</td>
<td>21.6</td>
<td>25.5</td>
<td>26.8</td>
<td>27.6</td>
<td>28.5</td>
<td>33.33</td>
</tr>
<tr>
<td>Hausner’s ratio</td>
<td>1.28</td>
<td>1.34</td>
<td>1.37</td>
<td>1.38</td>
<td>1.44</td>
<td>1.5</td>
</tr>
<tr>
<td>Angle of repose</td>
<td>27.5</td>
<td>28.2</td>
<td>26.3</td>
<td>27.1</td>
<td>26.5</td>
<td>27.2</td>
</tr>
<tr>
<td><strong>Post-compression parameters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight variation (mg)</td>
<td>263±0.21</td>
<td>264±0.21</td>
<td>265±0.12</td>
<td>265±0.43</td>
<td>266±0.12</td>
<td>265±0.11</td>
</tr>
<tr>
<td>Tablet thickness (mm)</td>
<td>2.15</td>
<td>2.14</td>
<td>2.15</td>
<td>2.13</td>
<td>2.13</td>
<td>2.11</td>
</tr>
<tr>
<td>Tablet hardness (kg/cm²)</td>
<td>4</td>
<td>3.7</td>
<td>3.5</td>
<td>3.7</td>
<td>3.4</td>
<td>3.9</td>
</tr>
<tr>
<td>Friability (%)</td>
<td>0.13</td>
<td>0.14</td>
<td>0.15</td>
<td>0.17</td>
<td>0.14</td>
<td>0.12</td>
</tr>
<tr>
<td>Wetting time (s)</td>
<td>28</td>
<td>27</td>
<td>23</td>
<td>26</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Disintegration time (s)</td>
<td>21</td>
<td>20</td>
<td>21</td>
<td>20</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>Drug content (%)</td>
<td>99.15</td>
<td>99.22</td>
<td>99.32</td>
<td>99.38</td>
<td>99.65</td>
<td>99.72</td>
</tr>
</tbody>
</table>

Figure 1: In vitro release profile of valsartan oral disintegrating tablets formulations
The reason may be due to the presence of higher concentration of crospovidone having greater wetting property [Figure 1].

**CONCLUSION**

Finally, oral dispersible tablets of valsartan prepared using coprocessed superdisintegrants may provide faster, safer, and effective drug delivery along with patient compliance in the management of hypertension.

**REFERENCES**

INTRODUCTION

The objective of present research work is to enhance the aqueous solubility of poorly water-soluble drug lumefantrine using liquisolid technique. Lumefantrine, also known as benflumetol, is an antimalarial drug. It is a long-acting antimalarial drug and is highly effective in the treatment of resistant Plasmodium falciparum malaria.\(^1\) It belongs to BCS Class IV having low solubility and low permeation. The drug is having low solubility (0.092 mg/mL) and oral bioavailability of 18%.

MATERIALS AND METHODS

Lumefantrine was kindly gifted by Cipla Pharmaceuticals (Pithampur). All other chemicals and excipients used were of analytical grade.

EXPERIMENTAL METHODS

Formulation of lumefantrine capsule using drug solution and suspension method

Desired quantities of drug and non-volatile solvents were accurately weighed in a beaker and then stirred continuously, until a homogenous drug solution/suspension was obtained. The system was subjected to sonication for approximately 1 min to evenly distribute the drug with the non-volatile liquid. In the second stage, calculated quantities of carrier material were added to the liquid medicament and evenly spread as a uniform layer on the surfaces of the mortar for 5 min to allow the drug solution to be absorbed in interior of the powder particles. In the third stage, the coating material was added and triturated.\(^2\)

Evaluation of liquisolids of lumefantrine

Liquisolid systems of lumefantrine were evaluated for flow properties, water solubility, drug content, and in vitro dissolution studies.

RESULTS AND DISCUSSION

The formulation and evaluation parameters of lumefantrine liquisolid systems were given in Tables 1 and 2.

In vitro release studies and FTIR and DSC studies

The in vitro release studies, FTIR and DSC studies were performed. The F9 Formulation showed maximum cumulative percent release of 98.7% within 60 min.

Key words: Aerosil, avicel, lumefantrine, PEG 400, propylene glycol, tween 80
CONCLUSION

It can be concluded that dissolution studies revealed increased dissolution profile and enhanced solubility of lumefantrine liquisolid formulations compared to that of pure drug.

REFERENCES

Formulation and Evaluation of Sublingual Tablet of Valsartan to Prevent its Extensive First-pass Metabolism

Deepak Joshi, Arti Majumdar, Neelesh Malviya
Department of Pharmaceutics, Smriti College of Pharmaceutical Education Indore, Madhya Pradesh, India

Abstract

The objective of the study was to formulate sublingual tablets of Valsartan for improving its oral bioavailability and provides fast onset of action. **Method:** The solid dispersion of Valsartan prepared with beta-cyclodextrin in proportion of 1:0.5 and solubility study was performed. The prepared solid dispersion was used in the formulation of sublingual tablet of Valsartan by direct compression. Sublingual tablets were formulated using superdisintegrants crospovidone and sodium starch glycolate. **Results:** F1 to F7 formulations were prepared. The formulations were evaluated for physical properties, weight variation, disintegration time, content uniformity, wetting time, and *in vitro* dissolution. F3 formulation showed the disintegration time of 40 s and *in vitro* drug release 96.41% in 30 min.

**Key words:** Crospovidone, sodium starch glycolate, sublingual, Valsartan

INTRODUCTION

Oral drug delivery system achieved a great success and very common route of drug administration. The reason behind this popularity may be by its “ease of administration” but one factor may affect its popularity and use of administration, i.e., extensive first-pass metabolism. The drug degrades through extensive first pass metabolism therefore have low bioavailability. Sublingual route of drug referred to a method by which a drug is administered by the mouth in such way that the drug is rapidly absorbed by the blood vessels rather than absorbing through GIT. Valsartan is an angiotensin-receptor blocker, which is an antagonist of angiotensin II receptor used in the treatment of hypertension. Valsartan is poorly water-soluble drug. It has aqueous solubility <1 mg/mL. Valsartan comes under BSC Class-II drug. Valsartan undergoes extensive hepatic first-pass metabolism. It has oral bioavailability of 23–25%. The present research focus on the formulation and evaluation of sublingual tablets of valsartan using superdisintegrants.

MATERIALS AND METHODS

Valsartan was obtained as a gift sample from Hetero Drugs Hyderabad. Sodium starch glycolate and lactose were obtained from HiMedia laboratories. Crospovidone was obtained from Chemco laboratories. Microcrystalline cellulose was obtained from Oxford laboratory reagent Thane.

**Solubility studies**

Solubility of valsartan in water was 0.596 mg/mL, in buffer (pH6.8) was 1.131 mg/mL, in ethanol was 2.84 mg/mL, and in methanol was 3.662 mg/mL.

**Preparation of solid dispersion by kneading method**

In this method, drug and polymer were taken to reduce the size of the mixture. The distilled water was added in physical mixture, and slurry mass was formed which dried in hot air oven at 45°C. The dried product was passed through sieve.

Address for correspondence:
Deepak Joshi, Smriti College of Pharmaceutical Education Indore, Madhya Pradesh, India.
E-mail: artijmajumdar10@gmail.com
no.36. After that, solubility study performed and reported as solubility of solid dispersion using Valsartan with polymer PVP K30 was 1.820 mg/mL, PEG-6000 was 2.368 mg/mL, and beta-cyclodextrin was 3.009 mg/mL.

**Formulation and evaluation of sublingual tablets of valsartan**

The formulation of the sublingual tablet of Valsartan was prepared by direct compression method [Tables 1-4].

### RESULTS AND DISCUSSION

Formulations of sublingual tablets of 7 batches were prepared by changing the concentration of sodium starch glycolate and crospovidone. The DSC and FTIR study not show any interaction between valsartan and excipients. The hardness of tablets and friability was in the limit of acceptance. Uniformity of weight of all the formulations was also within the range. Wetting time, disintegration time, and content uniformity reported in the Table 3. The *in vitro* drug release

---

### Table 1: Formulation of sublingual tablets of valsartan

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valsartan (mg)</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>SSG (mg)</td>
<td>-</td>
<td>5 (2)</td>
<td>10 (4)</td>
<td>15 (6)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CP (mg)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5 (2)</td>
<td>10 (4)</td>
<td>15 (6)</td>
</tr>
<tr>
<td>Lactose (mg)</td>
<td>120</td>
<td>115</td>
<td>110</td>
<td>105</td>
<td>115</td>
<td>110</td>
<td>105</td>
</tr>
<tr>
<td>Sucrose (mg)</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>MCC (mg)</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Talc (mg)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

### Table 2: Pre-compression parameters of blend

<table>
<thead>
<tr>
<th>Parameters</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk density (g/mL)</td>
<td>0.612</td>
<td>0.601</td>
<td>0.608</td>
<td>0.629</td>
<td>0.600</td>
<td>0.587</td>
<td>0.606</td>
</tr>
<tr>
<td>Tapped density (g/mL)</td>
<td>0.739</td>
<td>0.716</td>
<td>0.699</td>
<td>0.724</td>
<td>0.683</td>
<td>0.692</td>
<td>0.711</td>
</tr>
<tr>
<td>Angle of repose</td>
<td>25.8</td>
<td>22.3</td>
<td>24.7</td>
<td>21.65</td>
<td>26.88</td>
<td>26.24</td>
<td>25.07</td>
</tr>
<tr>
<td>Compressibility index (%)</td>
<td>17.18</td>
<td>16.06</td>
<td>13.01</td>
<td>13.12</td>
<td>12.15</td>
<td>15.17</td>
<td>14.76</td>
</tr>
<tr>
<td>Hausner’s ratio</td>
<td>1.20</td>
<td>1.19</td>
<td>1.14</td>
<td>1.15</td>
<td>1.13</td>
<td>1.17</td>
<td>1.17</td>
</tr>
</tbody>
</table>

### Table 3: Post compression parameters of sublingual valsartan tablets

<table>
<thead>
<tr>
<th>Parameters</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (mm)</td>
<td>10.3</td>
<td>10.3</td>
<td>10.7</td>
<td>10.5</td>
<td>10.2</td>
<td>10.1</td>
<td>10.3</td>
</tr>
<tr>
<td>Hardness (kg/cm²)</td>
<td>3.0</td>
<td>3.4</td>
<td>3.9</td>
<td>3.3</td>
<td>3.1</td>
<td>3.8</td>
<td>3.4</td>
</tr>
<tr>
<td>Thickness (mm)</td>
<td>2.0</td>
<td>1.93</td>
<td>1.95</td>
<td>1.90</td>
<td>2.20</td>
<td>1.98</td>
<td>1.91</td>
</tr>
<tr>
<td>Friability (%)</td>
<td>0.69</td>
<td>0.54</td>
<td>0.23</td>
<td>0.75</td>
<td>0.71</td>
<td>0.46</td>
<td>0.42</td>
</tr>
<tr>
<td>Weight variation (mg)</td>
<td>248±0.82</td>
<td>248±0.31</td>
<td>250±0.99</td>
<td>252±0.11</td>
<td>249±0.40</td>
<td>250±0.54</td>
<td>250±0.38</td>
</tr>
<tr>
<td>Wetting time</td>
<td>90</td>
<td>39</td>
<td>30</td>
<td>27</td>
<td>30</td>
<td>21</td>
<td>26</td>
</tr>
<tr>
<td>Disintegration time</td>
<td>178</td>
<td>58</td>
<td>41</td>
<td>28</td>
<td>46</td>
<td>35</td>
<td>39</td>
</tr>
<tr>
<td>Content uniformity</td>
<td>99.12</td>
<td>99.87</td>
<td>99.54</td>
<td>99.01</td>
<td>99.83</td>
<td>99.43</td>
<td>99.17</td>
</tr>
</tbody>
</table>

### Table 4: *in vitro* drug release of sublingual valsartan tablets

<table>
<thead>
<tr>
<th>Time (min.)</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>31.33</td>
<td>68.80</td>
<td>64.39</td>
<td>81.40</td>
<td>54.24</td>
<td>60.13</td>
<td>66.51</td>
</tr>
<tr>
<td>10</td>
<td>42.37</td>
<td>73.30</td>
<td>84.08</td>
<td>83.20</td>
<td>60.13</td>
<td>74.69</td>
<td>77.55</td>
</tr>
<tr>
<td>15</td>
<td>51.04</td>
<td>82.46</td>
<td>90.54</td>
<td>87.61</td>
<td>70.03</td>
<td>83.44</td>
<td>84.99</td>
</tr>
<tr>
<td>20</td>
<td>59.05</td>
<td>88.43</td>
<td>91.84</td>
<td>91.10</td>
<td>80.25</td>
<td>91.21</td>
<td>90.63</td>
</tr>
<tr>
<td>25</td>
<td>62.49</td>
<td>94.15</td>
<td>96.17</td>
<td>91.34</td>
<td>87.86</td>
<td>92.11</td>
<td>92.75</td>
</tr>
<tr>
<td>30</td>
<td>65.02</td>
<td>94.23</td>
<td>96.41</td>
<td>91.74</td>
<td>90.31</td>
<td>93.99</td>
<td>94.22</td>
</tr>
</tbody>
</table>
of tablets was determined, and F3 formulation showed maximum cumulative percentage drug release.

**CONCLUSION**

Sublingual tablets of valsartan were successfully prepared which concluded that solubility of Valsartan was increased using solid dispersion prepared by Kneading technique.

**REFERENCES**


INTRODUCTION

Topical fungal infections of the skin are one of the often faced dermatological diseases in worldwide. The incidence of superficial fungal infections of skin, hair, and nails has been increased. It has been estimated that about 40 million people have suffered from fungal infections in developing and underdeveloped nations. Dermatophyte infections of the feet represent the most common fungal infections due to the use of occlusive footwear. The incidences of superficial and deep skin fungal infections are rising. Luliconazole is used for the treatment of the local and systemic fungal infection. However, one of the major problems for efficient drug delivery is low penetration rate of luliconazole due to its high solubility and low permeability. Luliconazole is used for the treatment of local and systemic fungal infection. The low penetration rate, high solubility and low permeability of luliconazole is challenging for its formulation and development. Further, the physicochemical modification in the drug by means of phospholipid membrane also promises to prolong the drug action. A number of problems associated with drug molecule such as bioavailability, degradation, stability, and side effects can be overcome by incorporating it into ethosomes. The ethosomes of luliconazole were prepared by cold method and were evaluated. In vitro release of F7 formulation was higher than other formulation prepared. The ethosomal gel formulation of luliconazole was evaluated for organoleptic characteristics. The pH of gel base and freshly prepared ethosomal gel noted down the pH of gel base was found to be 7.2 and pH of ethosomes gel of different formulation was presented in the table. The viscosity of Carbopol 934 gel base was found to be 740.00 cps whereas viscosity of ethosomal gel was given in the table. The spreadability of ethosomal gel was also recorded. The spreadability results showed that ethosomal gel was most effective, i.e., it showed best result for spreadability. The extrudability of ethosomal gel was found to be positive except in F2 and F3. The percentage yield of ethosomal gel was found in between 94.71% and 98.43%. Ethosomal gel was found to be homogeneous and no grittiness was noted. Hence, it was concluded that the formulation F7 has better results as compared to other formulations.

Key words: Ethosomal Gel, Luliconazole, antifungal, topical formulation

Address for correspondence:
Avika Sharma, College of Pharmacy (Previously known as central India Institute of Pharmacy), Dr. A.P.J.Abdul Kalam University, Indore, Madhya Pradesh, India
E-mail: principalcop@aku.ac.in
MATERIALS AND METHODS

Ethosomal formulations were prepared using the cold method. The ethanolic vascular system was composed of phospholipid (2.0–4% W/V), ethanol (20–40% V/V), propylene glycol (20% V/V), drug (luliconazole, 0.5% W/V), and distilled water to 100% (V/V). Phospholipid was dissolved along with the drug in ethanol. This mixture was heated to 400°C ± 10°C and a fine stream of distilled water was added slowly, with constant mixing at 700 rpm with a mechanical stirrer in a closed container. Mixing was continued for an additional 5 min, while maintaining the system at 400°C ± 10°C. The preparation was left to cool at room temperature for 30 min and then it was sonicated at 40°C for five cycles of 3 min each with a minute rest between cycles using a probe sonicator. Nine formulations were prepared using different concentration of phospholipid and ethanol among them optimized formulation was selected for characterization and evaluation studies [Table 1].

Preparation of the carbopol gel

Carbopol 934 forms very good consistency transparent gel at low concentration. 1% Carbopol gel base was prepared by dispersing 1 g Carbopol 934 in 90 mL hot distilled water in which 10 mL glycerol was previously added. Accurately weighed quantity of methylparaben and propylparaben was also added into it. The mixture was stirred until thickening occurred and then neutralized by the dropwise addition of 50% (w/w) triethanolamine to achieve a transparent gel.

Incorporation of ethosomes in the gel base

The ethosomal formulation was slowly added in Carbopol 934 gel base with gentle stirring. Finally, the ethosomal gel was mixed using a mechanical stirrer for 5 min.

Evaluation of ethosomes

The formulated ethosomes were evaluated as per standard procedure.

RESULTS AND CONCLUSION

The ethosomes of luliconazole [Figure 1, F7] were prepared by cold method and were evaluated. In vitro release of F7 formulation was higher than other formulation prepared. The ethosomal gel formulation of luliconazole was evaluated for organoleptic characteristics. The pH of gel base and freshly prepared ethosomal gel noted down the pH of gel base was found to be 7.2 and pH of ethosomes gel of different formulation was presented in table. The viscosity of Carbopol 934 gel base was found to be 740,00 cps whereas viscosity of ethosomal gel was given in table. The spreadability of ethosomal gel was also recorded. The spreadability results showed that ethosomal gel was most effective, i.e. it showed best result for spreadability. The extrudability of ethosomal gel was found to be positive except in F2 and F3. The percentage yield of ethosomal gel was found in between 94.71% and 98.43%. Ethosomal gel was found to be homogeneous, and no grittiness was noted. Hence, it was concluded that the formulation F7 has better results as compared to other formulations.

Table 1: Compositions of different ethosomal formulation of Luliconazole

<table>
<thead>
<tr>
<th>Formulation code</th>
<th>Concentration of phospholipid (w/v) (%)</th>
<th>Concentration of ethanol (v/v) (%)</th>
<th>Concentration of propylene glycol (v/v) (%)</th>
<th>Concentration of drug (w/v) (%)</th>
<th>Concentration of distilled water (v/v) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>2</td>
<td>20</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
<tr>
<td>F2</td>
<td>3</td>
<td>30</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
<tr>
<td>F3</td>
<td>4</td>
<td>40</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
<tr>
<td>F4</td>
<td>2</td>
<td>30</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
<tr>
<td>F5</td>
<td>3</td>
<td>40</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
<tr>
<td>F6</td>
<td>4</td>
<td>20</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
<tr>
<td>F7</td>
<td>2</td>
<td>40</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
<tr>
<td>F8</td>
<td>3</td>
<td>20</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
<tr>
<td>F9</td>
<td>4</td>
<td>30</td>
<td>20</td>
<td>0.5</td>
<td>Up to 100</td>
</tr>
</tbody>
</table>

Figure 1: Transmission electron microscopy of ethosomes (F7)
REFERENCES

INTRODUCTION

Bacterial conjunctivitis is an infection of eye’s mucous membrane. Conventionally, eye drops, gels, ointments, suspensions, etc., are available for treatment of conjunctivitis but are associated with various disadvantages such as rapid precorneal elimination, nasolacrimal drainage, frequent instillation, conjunctival absorption, short residence time, and low ocular bioavailability. To overcome these disadvantages, microemulsion formulation is widely explored, as they increase potency, improves bioavailability, absorption, contact time, drug loading, increases transcorneal drug permeation, and reduces systemic side effects. The instillation of o/w microemulsion into eye is beneficial because it increases membrane permeability due to the presence of surfactant and cosurfactants.

MATERIALS AND METHODS

Materials

Gatifloxacin was obtained as a gift sample from M/s Allergan (India) Ltd., oleic acid and Tween 80 were purchased from Loba chemie Pvt. Ltd. (Mumbai), Cremophor RH 40 was obtained as a gift sample from BASF (India), Dialysis membrane was purchased from HiMedia Laboratories (Mumbai), and Goat eye and blood were obtained from slaughterhouse.

Development of gatifloxacin microemulsion formulation

On the basis of solubility of drug and oil accommodation capacity, oleic acid, Tween 80, and Cremophor RH 40 were chosen as oil phase, surfactant, and cosurfactant, respectively, and 3:1 S mix showed maximum microemulsion region, therefore, was selected for formulation of microemulsion. Weighed quantity of gatifloxacin drug was added in measured volume of oleic acid and S mix, a calculated amount of water was gradually added to the above mixture with continuous stirring to obtain clear microemulsion of gatifloxacin [Figure 1].

Gatifloxacin-loaded Microemulsion-based Ocular Drug Delivery System for Treatment of Bacterial Conjunctivitis

Divya Motwani, Sadaf Baig, Prakash K. Soni

Department of Pharmacy, Industrial Pharmacy Research Lab, Shri G.S. Institute of Technology & Science, Indore, Madhya Pradesh, India

Abstract

Gatifloxacin is a fluoroquinolone antibiotic used for the treatment of bacterial conjunctivitis. Conventionally used Gatifloxacin eye drops are required to be instilled frequently due to poor transcorneal permeation, rapid elimination induced by tear turnover, blinking, and drainage of formulation. Thus, in present research a microemulsion-based ocular formulation was developed with increased residence time, improved corneal penetration and reduced dosing frequency resulting into effective therapeutic effect and patient compliance. The microemulsion was prepared using oleic acid as oil phase, tween 80 as surfactant and Cremophor RH 40 as cosurfactant. The pH was found to be 5.86, viscosity 25 mPas, globule size 106 nm, zeta potential −22 mV, drug content 95.43%, and in vitro release after 8 h was 99.39%. The transcorneal permeation in freshly excised goat cornea of marketed eye drop product after 12 h was 27.01% while of developed formulation was 43.16% which showed that developed formulation had enhanced transcorneal permeation than the marketed eye drop. Therefore, on the basis of results, gatifloxacin microemulsion-based formulation can overcome the drawbacks of conventional eye drop formulation.

Key words: Bacterial conjunctivitis, gatifloxacin, microemulsion

Address for correspondence:
Prakash K. Soni, Department of Pharmacy, Industrial Pharmacy Research Lab, Shri G.S. Institute of Technology & Science, Indore, Madhya Pradesh, India. E-mail: soniprakashpharma@gmail.com
**Development of gatifloxacin microemulsion-based eye drop formulation**

Gatifloxacin microemulsion-based eye drop was formulated using NaCl as tonicity adjusting agent, and benzalkonium chloride as preservative in prepared microemulsion [Table 1].

**Evaluation of developed formulation**

**Physicochemical properties**

The pH was determined using pH meter and viscosity was determined by Brookfield R/S plus rheometer. Globule size and zeta potential were analyzed by nano zeta particle size analyzer nanotrac. For evaluating drug content, 1 mL of microemulsion was diluted with demineralized water and analyzed spectrophotometrically.

**In vitro drug release**

*In vitro* drug release of microemulsion formulation was performed using dialysis membrane (MWCO 12000–14000)

**RESULTS AND DISCUSSION**

**Physicochemical properties**

Physicochemical properties were evaluated. The pH was found to be 5.86, viscosity 25 mPas, globule size 106 nm, zeta potential −22 mV, and drug content was 95.43%.

**In vitro drug release**

*In vitro* drug release after 8 h of gatifloxacin microemulsion-based eye drop formulation was found to be 99.39% which is graphically shown in Figure 2.

**Transcorneal drug permeation study**

Transcorneal drug permeation of marketed formulation after 12 h was 27.01% while of the developed formulation was 43.16% which shows that developed formulation had enhanced permeation than the marketed eye drop [Figure 2].

![Table 1: Composition of Gatifloxacin microemulsion-based eye drop formulation](image)

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Quantity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gatifloxacin</td>
<td>0.3</td>
</tr>
<tr>
<td>Oleic acid</td>
<td>1.5</td>
</tr>
<tr>
<td>$S_{mix}$ (Tween80:CremophorRH 40)</td>
<td>12.5</td>
</tr>
<tr>
<td>NaCl</td>
<td>0.4</td>
</tr>
<tr>
<td>Benzalkonium chloride</td>
<td>0.001</td>
</tr>
<tr>
<td>Water (q.s. to)</td>
<td>100</td>
</tr>
</tbody>
</table>

**Figure 1:** Pseudoternary diagram of different surfactant: Cosurfactant ratio (a) $S_{mix}$-1:1 (b) $S_{mix}$-1:2 (c) $S_{mix}$-1:3 (d) $S_{mix}$-2:1 (e) $S_{mix}$-3:1
CONCLUSION

On the basis of results of study, it can be concluded that microemulsion-based eye drop formulation of gatifloxacin could overcome the drawbacks of conventional eye drop formulation and this could be recommended as a superior substitute of presently available marketed formulation.

REFERENCES

INTRODUCTION

Historically oral drug administration has been the predominant route for drug delivery. Oral route has been one of the most popular routes of drug delivery due to its ease of administration, patience compliance, least sterility constraints, and flexible design of dosage forms. It is known to be the most popular route of drug administration due to the fact the gastrointestinal physiology offers more flexibility in dosage form design than most other routes.[1-3]

MATERIALS AND METHODS

Extraction and evaluation of polysaccharides

The natural polysaccharides from the respective natural source (tamarind and bael fruit) were extracted following the method described by Rao et al. color: After complete extraction and drying the polysaccharides were evaluated for color by visualization. pH: A 1% w/v solution of the polysaccharides were prepared, and its pH was measured in digital pH meter.

Viscosity

The viscosities of 1% w/v solution of the polysaccharides were measured in Ostwald viscometer.

Preparation of matrix tablets

Tablets containing metformin HCl were prepared by wet granulation technique.

RESULTS AND DISCUSSION

Pre and post compression characteristics evaluation’s data tabulated in Table 1. IR spectrum for drug excipients compatibility has been shown in Figure 1. Invitro drug release profile of the prepared tablet with TPP exhibited a sustained and controlled pattern over an

Address for correspondence:
Solanki, Charak Institute of Pharmacy, Mandesher, Madhya Pradesh, India.
E-mail: dharmendrasolanki29@gmail.com
extended time period whereas formulation containing BP releases 98.5% of drug in just 6 hours. Kinetic modeling of drug release shows that the drug release from the matrix tablet is best explained by korsemeyer peppas diffusion mechanism.

**DRUG POLYMER COMPATIBILITY STUDY**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>Zero-order ( r^2 )</th>
<th>First-order ( r^2 )</th>
<th>Higuchi Matrix ( r^2 )</th>
<th>Peppas plot n value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF-1</td>
<td>0.9823</td>
<td>0.9461</td>
<td>0.8785</td>
<td>0.922</td>
</tr>
<tr>
<td>TF-2</td>
<td>0.9934</td>
<td>0.9466</td>
<td>0.8649</td>
<td>0.996</td>
</tr>
<tr>
<td>TF-3</td>
<td>0.9850</td>
<td>0.9540</td>
<td>0.8644</td>
<td>0.974</td>
</tr>
<tr>
<td>TF-4</td>
<td>0.9941</td>
<td>0.9637</td>
<td>0.8625</td>
<td>1.004</td>
</tr>
<tr>
<td>TF-5</td>
<td>0.9923</td>
<td>0.9627</td>
<td>0.8503</td>
<td>1.040</td>
</tr>
<tr>
<td>BF-1</td>
<td>0.5467</td>
<td>0.9736</td>
<td>0.9404</td>
<td>0.396</td>
</tr>
<tr>
<td>BF-2</td>
<td>0.6156</td>
<td>0.9651</td>
<td>0.9668</td>
<td>0.415</td>
</tr>
<tr>
<td>BF-3</td>
<td>0.5735</td>
<td>0.9660</td>
<td>0.9486</td>
<td>0.403</td>
</tr>
<tr>
<td>BF-4</td>
<td>0.6894</td>
<td>0.9884</td>
<td>0.9709</td>
<td>0.466</td>
</tr>
<tr>
<td>BF-5</td>
<td>0.6277</td>
<td>0.9242</td>
<td>0.9682</td>
<td>0.414</td>
</tr>
</tbody>
</table>

**CONCLUSION**

The present investigation was carried out to develop sustained delivery of metformin HCL for an effective and safe therapy using three natural polymers, i.e., Tamarind pulp polysaccharide and bael polysaccharides. From this present study, it can be concluded that the drug content was uniform in all the formulations of tablets prepared. The low values of standard deviation indicate uniform distribution of drug within the matrices. Infrared spectroscopic indicated that the drug is compatible with the polymers. From all above parameters, it is concluded TPP are suitable polymer for the modify the release property of metformin HCL by preparing sustained-release matrix tablet.

**REFERENCES**

Development and Evaluation of Floating Tablets of Ranitidine in Treatment of Peptic Ulcer

Arpit Singh Chouhan, Ankita Mandal, Arti Majumdar, Neelesh Malviya

Department of Pharmaceutics, Smriti College of Pharmaceutical Education Indore, Madhya Pradesh, India

Abstract

The present study was conducted with an objective of development of gastroretentive floating drug delivery system in which ranitidine hydrochloride used as a model drug. Development of ranitidine floating tablet was to increase its bioavailability by increasing residence time release in the upper part of gastrointestinal tract for longer therapeutic effect. The tablets of ranitidine hydrochloride were prepared by direct compression method, using polymers such as Carbopol 934, xanthan gum, and guar gum. The floating tablets were characterized for lag time, floating time, weight variation, drug content, and dissolution profile. The effect of polymer concentration on floating time and drug release was observed from all formulation from F0 to F6. On investigating by parameter result has found that F3 and F6 formulation have shown longer buoyant property and prolonged drug release that could be advantage in enhancement of pharmacokinetic profile of drug and increased bioavailability; hence, drug release of formulation could be sustained for longer time by increasing the concentration of polymer.

Key words: Drug release, floating time, guar gum, ranitidine hydrochloride, xanthan gum

INTRODUCTION

The oral drug delivery consists of convenient oral dosage forms which are developed in market for its significant and fundamental therapeutic advantages which are maintained by dosage form such as help in ease of administration, patient compliance, and patient reliable, and helpful in patient acceptance of formulation. The aim of gastroretentive technology is to be an alternative to overcome the drug degradation and less retention time. The fundamental advantage of long gastric retention of floating tablet is to improve bioavailability, reduces drug waste or dose dumping. Floating drug delivery system provides benefit in local drug delivery to upper stomach region in the treatment of peptic ulcer.

MATERIALS AND METHODS

Ranitidine hydrochloride was received as a gift sample from Modern labs Pvt. Ltd Indore, India. Carbopol, xanthan gum, guar gum, and all excipients were procured from Smriti College of Pharmaceutical Education, Indore, and ingredients used in formulation were of laboratory grade.

Method of preparation

By direct compression method

The composition ranitidine hydrochloride floating tablet is shown in Table 1.

RESULTS AND DISCUSSION

The floating tablet of Ranitidine HCl was prepared and evaluated. The precompression parameters of formulations given in Table 2 and the evaluation of physicochemical properties of formulations F0F6 formulations given in Table 3. In-vitro drug release study were given in Table 4.

CONCLUSION

Ranitidine hydrochloride degrades at intestine due to instability at higher alkaline pH; thus, bioavailability can be increased by increasing its retention time and by

Address for correspondence:
Arpit Singh Chouhan, Smriti College of Pharmaceutical Education Indore, Madhya Pradesh, India
E-mail: arpitsingh1118@gmail.com
Table 1: Composition of Ranitidine HCl floating tablet

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>F0</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranitidine HCL</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Guar gum</td>
<td>-</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Xanthan gum</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Carbopol</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
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<tr>
<td>Magnesium stearate</td>
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<td>5</td>
</tr>
<tr>
<td>Citric acid</td>
<td>20</td>
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<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Talc</td>
<td>5</td>
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<td>Lactose</td>
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<td>200</td>
<td>190</td>
<td>180</td>
<td>200</td>
<td>190</td>
<td>180</td>
</tr>
</tbody>
</table>

Table 2: Pre-compression parameters of formulations

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Bulk density g/mL</th>
<th>Tapped density g/mL</th>
<th>Angle of repose</th>
<th>Carr's index</th>
<th>Hauser's ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>0.41</td>
<td>0.416</td>
<td>38 (fair)</td>
<td>19.21 (fair)</td>
<td>1.20 (good)</td>
</tr>
<tr>
<td>F1</td>
<td>0.38</td>
<td>0.496</td>
<td>26 (excellent)</td>
<td>14.54 (good)</td>
<td>1.16 (good)</td>
</tr>
<tr>
<td>F2</td>
<td>0.42</td>
<td>0.521</td>
<td>28 (excellent)</td>
<td>15.01 (good)</td>
<td>1.09 (excellent)</td>
</tr>
<tr>
<td>F3</td>
<td>0.43</td>
<td>0.536</td>
<td>31 (good)</td>
<td>18.04 (fair)</td>
<td>1.14 (good)</td>
</tr>
<tr>
<td>F4</td>
<td>0.40</td>
<td>0.498</td>
<td>27 (excellent)</td>
<td>13.44 (good)</td>
<td>1.19 (fair)</td>
</tr>
<tr>
<td>F5</td>
<td>0.42</td>
<td>0.566</td>
<td>30 (good)</td>
<td>15.85 (good)</td>
<td>1.16 (good)</td>
</tr>
<tr>
<td>F6</td>
<td>0.48</td>
<td>0.598</td>
<td>34 (good)</td>
<td>18.98 (fair)</td>
<td>1.18 (fair)</td>
</tr>
</tbody>
</table>

Table 3: Evaluation of physicochemical properties of formulations F0-F6 formulations

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Hardness (kg/cm²)</th>
<th>Thickness (mm)</th>
<th>Friability %</th>
<th>Wt variation</th>
<th>Lag time (s)</th>
<th>Drug content</th>
<th>Floating time (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>3.9</td>
<td>3.2</td>
<td>0.69</td>
<td>510</td>
<td>52</td>
<td>97.23</td>
<td>10-11</td>
</tr>
<tr>
<td>F1</td>
<td>4.1</td>
<td>3.2</td>
<td>0.89</td>
<td>524</td>
<td>53</td>
<td>98.10</td>
<td>15-16</td>
</tr>
<tr>
<td>F2</td>
<td>4.0</td>
<td>3.5</td>
<td>0.75</td>
<td>494</td>
<td>69</td>
<td>94.35</td>
<td>18-19</td>
</tr>
<tr>
<td>F3</td>
<td>4.3</td>
<td>3.6</td>
<td>0.84</td>
<td>506</td>
<td>71</td>
<td>96.52</td>
<td>19-20</td>
</tr>
<tr>
<td>F4</td>
<td>3.9</td>
<td>3.4</td>
<td>0.78</td>
<td>516</td>
<td>56</td>
<td>99.11</td>
<td>16-17</td>
</tr>
<tr>
<td>F5</td>
<td>4.2</td>
<td>3.7</td>
<td>0.79</td>
<td>502</td>
<td>59</td>
<td>102.4</td>
<td>19-20</td>
</tr>
<tr>
<td>F6</td>
<td>5.1</td>
<td>3.9</td>
<td>0.51</td>
<td>518</td>
<td>82</td>
<td>98.54</td>
<td>18-19</td>
</tr>
</tbody>
</table>

Table 4: In vitro drug release study

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>F0%CDR</th>
<th>F1%CDR</th>
<th>F2%CDR</th>
<th>F3%CDR</th>
<th>F4%CDR</th>
<th>F5%CDR</th>
<th>F6%CDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17.89</td>
<td>8.30</td>
<td>6.0</td>
<td>5.5</td>
<td>6.89</td>
<td>5.4</td>
<td>3.22</td>
</tr>
<tr>
<td>2</td>
<td>39.32</td>
<td>14.01</td>
<td>10.20</td>
<td>8.7</td>
<td>10.6</td>
<td>8.90</td>
<td>5.27</td>
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<tr>
<td>3</td>
<td>50.32</td>
<td>26.01</td>
<td>16.94</td>
<td>13.2</td>
<td>15.1</td>
<td>13.01</td>
<td>9.96</td>
</tr>
<tr>
<td>4</td>
<td>59.27</td>
<td>30.01</td>
<td>20.99</td>
<td>22.1</td>
<td>19.7</td>
<td>16.08</td>
<td>14.96</td>
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<tr>
<td>5</td>
<td>66.27</td>
<td>36.01</td>
<td>28.23</td>
<td>26.5</td>
<td>27.77</td>
<td>21.54</td>
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<tr>
<td>6</td>
<td>77.22</td>
<td>43.33</td>
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<td>7</td>
<td>84.60</td>
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<td>8</td>
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<td>45.65</td>
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<td>-</td>
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<td>56.51</td>
<td>48.27</td>
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<td>10</td>
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<td>62.30</td>
<td>56.89</td>
<td>64.83</td>
<td>52.86</td>
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<td>11</td>
<td>-</td>
<td>71.23</td>
<td>70.62</td>
<td>63.25</td>
<td>69.27</td>
<td>62.53</td>
<td>55.45</td>
</tr>
<tr>
<td>12</td>
<td>-</td>
<td>76.86</td>
<td>75.06</td>
<td>68.91</td>
<td>75.5</td>
<td>66.65</td>
<td>62.87</td>
</tr>
</tbody>
</table>
prolonged drug release. From the above research work, different formulations of ranitidine hydrochloride were prepared using different concentration of xanthan gum and guar gum. On investigating by parameter said above result has found that F3 and F6 formulation have shown longer buoyant property and prolonged drug release that could be advantage in enhancement of pharmacokinetic profile of drug and increased bioavailability; hence, drug release of formulation could be sustained for longer time by increasing the concentration of polymer.

REFERENCES

INTRODUCTION

To overcome this problem, in recent years increasing attention have been focused in formulating mouth dissolving and disintegrating tablets that are intended to dissolve or disintegrate rapidly in the mouth.

MATERIALS AND METHODS

Metformin hydrochloride and other excipients use although the most of the analytical and identification parameters were already performed by Ziess Pharmaceuticals Pvt. Ltd., Baddi (H.P).

Methods for extraction of mucilage

Seeds of *Ocimum americanum* Linn. (200 g) were soaked for 20 h in distilled water. It was boiled for 30 min and then it was passed from the eight folds of muslin cloth. The mucilage was precipitated by adding acetone and separated mucilage was filtered with the help of filter paper. Then, it was dried at 45°C for 6 h. After drying, it was crushed into mortar and pestle to for fine powder. The powder was passed from 80# sieve. The separated mucilage was evaluated for solubility and swelling property.

Solubility studies

Solubility of mucilage was checked in hot water and solvents such as acetone, alcohol, ether, and chloroform (I.P.1996).

Formulation orally disintegrating tablets [Table 1]

Address for correspondence:
Manohar Chouhan, Dr. APJ Abdul Kalam University (S.O.P), Indore, Madhya Pradesh, India.
E-mail: manohar41mt6383@gmail.com
RESULTS AND DISCUSSION

Evaluation of pre-compression parameters of all batches [Table 2]

Table 1: Formulation orally disintegrating

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Formulation code (in mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin hydrochloride</td>
<td>F1 500  F2 500  F3 500  F4 500  F5 500</td>
</tr>
<tr>
<td>O. americum Linn.</td>
<td>5 10 15 20 25</td>
</tr>
<tr>
<td>NaHCO₃</td>
<td>25 25 25 25 25</td>
</tr>
<tr>
<td>Sodium starch glycolate</td>
<td>35 35 35 35 35</td>
</tr>
<tr>
<td>Mannitol</td>
<td>31 26 21 16 11</td>
</tr>
<tr>
<td>Magnesium stearate</td>
<td>4 4 4 4 4</td>
</tr>
<tr>
<td>Total</td>
<td>600 600 600 600 600</td>
</tr>
</tbody>
</table>

O. americum: Ocimum americanum

Table 2: Evaluation of pre-compression parameters of all batches

<table>
<thead>
<tr>
<th>Formulation code</th>
<th>Angle of repose (°)</th>
<th>Loose bulk density</th>
<th>Tapped bulk density</th>
<th>Carr’s index</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>32.69</td>
<td>0.614</td>
<td>0.700</td>
<td>12.29</td>
</tr>
<tr>
<td>F2</td>
<td>29.86</td>
<td>0.612</td>
<td>0.697</td>
<td>12.23</td>
</tr>
<tr>
<td>F3</td>
<td>29.74</td>
<td>0.612</td>
<td>0.700</td>
<td>12.65</td>
</tr>
<tr>
<td>F4</td>
<td>28.74</td>
<td>0.609</td>
<td>0.694</td>
<td>12.19</td>
</tr>
<tr>
<td>F5</td>
<td>27.87</td>
<td>0.612</td>
<td>0.694</td>
<td>11.83</td>
</tr>
</tbody>
</table>

Table 3: Evaluation of post-compression parameters of all batches

<table>
<thead>
<tr>
<th>Formulation code</th>
<th>Uniformity of weight (mg)</th>
<th>Thickness (mm)</th>
<th>Hardness (kg/cm²)</th>
<th>Friability (%)</th>
<th>Drug content (%)</th>
<th>Disintegration time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>599</td>
<td>3.92</td>
<td>4.74</td>
<td>0.96</td>
<td>96.9</td>
<td>75.6</td>
</tr>
<tr>
<td>F2</td>
<td>602</td>
<td>3.91</td>
<td>4.82</td>
<td>0.99</td>
<td>98.1</td>
<td>93.3</td>
</tr>
<tr>
<td>F3</td>
<td>600</td>
<td>3.90</td>
<td>5.08</td>
<td>0.97</td>
<td>98.01</td>
<td>86.3</td>
</tr>
<tr>
<td>F4</td>
<td>601</td>
<td>3.91</td>
<td>5.05</td>
<td>0.95</td>
<td>99.9</td>
<td>66.6</td>
</tr>
<tr>
<td>F5</td>
<td>601</td>
<td>4.09</td>
<td>5.06</td>
<td>0.98</td>
<td>99.09</td>
<td>71.0</td>
</tr>
</tbody>
</table>

Figure 2: Percentages drug release orally disintegrating tablets

CONCLUSION

In vitro  percentage release of metformin hydrochloride oral disintegrate tablets

Following the parameters of tablets were within acceptable official IP limits. The present study revealed that O. americanum Linn. seeds mucilage and other ingredients combination appears to be suitable for use as an immediate release orally disintegrate tablets because of its good wetting, good flow, and suitability for effervescent formulations. From the dissolution study, it was concluded that dried O. americanum Linn. seeds mucilage and other ingredients as a good for orally disintegration tablet of drug from the tablets.
REFERENCES


Dry Injection for Reconstitution of Ofloxacin Using Solid Solubilizers for Veterinary Use

R. K. Maheshwari, A. Padiyar
Department of Pharmacy, Shri G.S Institute of Technology and Science, Indore, Madhya Pradesh, India

Abstract

The concept of mixed solvency is an emerging field which can serve as a milestone for solubility enhancement and therefore deserves an urgent attention of the scientific community to assess its efficiency and applicability. Mixed solvency concept suggested that each substance present on the earth whether solid, liquid or gas has solubilizing power. In mixed solvency concept each substance (gas, liquid, or solid) is termed as solubilizer. Solubility enhancement by a single solubilizer in high concentration may raise the toxicity concern. Mixed solvency concept gives solution to this problem. Several solubilizers in small concentrations in a blend may give desired solubility for a given drug and hence may be safe (non-toxic). In future, the industries shall use the solubilizing properties of different additives for such purpose. The described research is one typical example where safe concentrations of solid additives have been used to prepare a dry injection for reconstitution of aspirin (a poorly water-soluble drug).

In this research work, solubility studies were performed in mixed solvent blend containing five solid solubilizers (in distilled water) for some poorly water-soluble drugs. Approximate, solubility of ofloxacin in distilled water at room temperature was found to be 0.283% w/v. An aqueous blend containing five solid additives, namely sodium benzoate (5% w/v), PVP K30 (5% w/v), PEG4000 (7.5% w/v), lignocaine hydrochloride (5% w/v), and niacinamide (2.5% w/v) were observed to have approximate solubility of ofloxacin, 2.418% w/v at room temperature. Therefore, a model dry injection for reconstitution of ofloxacin could be developed. 5 ml of this reconstituted solution contains 100 mg of ofloxacin.

Key words: Mixed Solvency, Ofloxacin, Dry Injection

INTRODUCTION

Ofloxacin is a third generation quinolone antibacterial agent with poor water solubility. There are various conventionally used solubility enhancement techniques but present research emphasis on mixed solvency concept proposed by Dr. R.K Maheshwari. Mixed solvency concept suggested that each substance present on the earth whether solid, liquid, or gas has solubilizing power. In future mixed solvency concept can be prove as panacea for solubility enhancements. As we know that all materials which exist in liquid state are known as solvents such as water, chloroform, methanol, propylene glycol, dimethylformamide, dimethyl sulfoxide, ethanol, and benzene. No solvent is universal solvent. In other words, we can say that although these all liquids are known as solvent, they are not good solvents for all solutes. For example, we know that water is good solvent for about one-third drugs and bad solvent for about two-third drugs. Thus, we can say that all liquids are good solvent for some solutes and bad solvents for other solutes. Similarly, in mixed solvency concept[1-5] each and every substance (gas, liquid, or solid) is good solubilizer for some solutes and bad solubilizer for other solutes. Mixed solvency concept gives solution to this problem. Several solubilizers in small concentrations in a blend may give desired solubility for a given drug and hence may be safe (non-toxic). In future, the industries shall use the solubilizing properties of different additives for such purpose. The described research is one typical example where safe concentrations of solid additives have been used to prepare a dry injection for reconstitution of ofloxacin (a poorly water-soluble drug). Approximate, solubility of ofloxacin in distilled water at room temperature was 0.283% w/v. An aqueous blend containing five solid additives, namely sodium benzoate (5% w/v), PVP K30 (5% w/v), PEG4000 (7.5% w/v), lignocaine hydrochloride (5% w/v), and niacinamide (2.5% w/v) were observed to have approximate solubility of ofloxacin, 2.418% w/v at room temperature. Therefore, a model dry injection for reconstitution of ofloxacin could be developed. 5 ml of this reconstituted solution contains 100 mg of ofloxacin.

Address for correspondence:
A. Padiyar, Department of Pharmacy, Shri G.S Institute of Technology and Science, Indore, Madhya Pradesh, India. E-mail: anirudhpadiyar23june@gmail.com
hydrochloride (5% w/v), and niacinamide (2.5% w/v) were observed to have approximate solubility of ofloxacin, 2.418% w/v at room temperature. Therefore, a model dry injection for reconstitution of ofloxacin could be developed. 5 ml of this reconstituted solution contains 100 mg of ofloxacin.

**MATERIALS**

Ofloxacin was procured as a gift sample from M/s Alkem Laboratories Ltd., Mumbai. Lignocaine hydrochloride and niacinamide were procured from Modern Laboratories, Indore. Tinidazole, norfloxacin, and piroxicam were procured as gift samples from M/s Alkem Laboratories Ltd., Mumbai. Frusemide was procured from M/s IPCA Laboratories Ltd., Ratlam and Indomethacin was procured from M/s Ranbaxy Laboratories Ltd., Dewas.

**EXPERIMENTAL**

**Solubility studies**

Approximate solubility studies were carried out to determine approximate solubilities of seven drugs in an aqueous blend containing safe solid additives of injection in safe concentrations (reported in literature). The solubilizing efficiencies of these additives were evaluated. The aqueous blend (B) contained 5% w/v sodium benzoate (a safe buffering agent), 5% w/v PVP K30 (a plasma expander), 2.5% w/v niacinamide (a safe stabilizer), 7.5% w/v PEG 4000 (a safe solubilizer), and 5% w/v lignocaine hydrochloride (a safe local anesthetic). Approximate solubilities of drugs (ofloxacin, norfloxacin, naproxen, tinidazole, piroxicam, frusemide, and indomethacin) were determined by shaking the excess of drug with 10 ml of the blend for about 20 min in a bottle and then filtration was done. Approximately, saturated solution of drugs was analyzed by ultraviolet (UV) spectrophotometry. Approximate solubilities of all seven drugs are reported in Table 2.[7]

Table 2 also gives solubilities of drugs in distilled water at room temperature (from literature). Approximate solubility of ofloxacin in distilled water at room temperature was obtained by shaking excess of ofloxacin with about 20 ml distilled water in a bottle for about 20 min. It was then filtered and filtrate was suitably diluted and analyzed spectrophotometrically. Result is presented in Table 2. The solubilities of remaining five drugs in distilled water at room temperature were taken from research papers.

Out of six drugs studied, ofloxacin was selected for further study. A model dry injection of ofloxacin was developed. Although ofloxacin has about 2.418% w/v solubility in the blend (B), an injection was developed having 2% w/v strength of ofloxacin. Thus, 5 mL of such solution contains 100 mg of ofloxacin.

**Formulation development of dry injection of ofloxacin**

Approximate solubility of ofloxacin in distilled water is 0.283% w/v at room temperature. Approximate solubility of ofloxacin in an aqueous solution (a mixed solvency blend) containing 5% w/v sodium benzoate, 5% w/v lignocaine hydrochloride, 5% w/v PVP K30, 7.5% w/v PEG 4000, and 2.5% w/v niacinamide is 2.418% w/v. Thus, a 2% w/v solution of ofloxacin can be made easily in the above-mentioned mixed solvency blend. Hence, 5 mL of such solution shall contain 100 mg of ofloxacin. It is evident from the literature that 5% w/v sodium benzoate is safely employed buffering agent in injections. PVP K30 is a plasma expander; therefore, 5% w/v PVP K30 is safe in injections. In this case, lignocaine hydrochloride is an additive (local anesthetic to reduce the pain of injection). PEG 4000, an additive (solubilizer) is safe in 7.5% w/v concentration in injections. Niacinamide (2.5% w/v) is a safely used stabilizer in injections. Thus, all five solid additives are present in safe concentrations in

<table>
<thead>
<tr>
<th>Name of drug</th>
<th>Solubility in distilled water at room temperature (% w/v)</th>
<th>Approximate solubility in blend (B) at room temperature (% w/v)</th>
<th>Solubility enhancement ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ofloxacin</td>
<td>0.283</td>
<td>2.418</td>
<td>8.54 fold</td>
</tr>
<tr>
<td>Norfloxacin</td>
<td>0.088[6]</td>
<td>0.652</td>
<td>7.4 fold</td>
</tr>
<tr>
<td>Tinidazole</td>
<td>0.538[8]</td>
<td>1.206</td>
<td>2.2 fold</td>
</tr>
<tr>
<td>Piroxicam</td>
<td>0.040[9]</td>
<td>0.994</td>
<td>24.8 fold</td>
</tr>
<tr>
<td>Frusemide</td>
<td>0.064[10]</td>
<td>2.013</td>
<td>31.4 fold</td>
</tr>
<tr>
<td>Indomethacin</td>
<td>0.036[11]</td>
<td>3.009</td>
<td>83.6 fold</td>
</tr>
</tbody>
</table>

Table 1: Composition of Blend B

<table>
<thead>
<tr>
<th>Solubilizers</th>
<th>Percentage composition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium benzoate</td>
<td>5</td>
</tr>
<tr>
<td>PVP K30</td>
<td>5</td>
</tr>
<tr>
<td>Niacinamide</td>
<td>2.5</td>
</tr>
<tr>
<td>PEG 4000</td>
<td>7.5</td>
</tr>
<tr>
<td>Lignocaine hydrochloride</td>
<td>5</td>
</tr>
</tbody>
</table>
mixed solvency blend. Due to the solubilizing effect of all five solids, the solubility of ofloxacin is enhanced tremendously, and an aqueous injection can be developed to contain 100 mg ofloxacin in 5 mL of the blend. A dry injection of ofloxacin can nicely be developed to have very good chemical stability in the form of dry injection for reconstitution.[12]

Table 3 gives a formula for model dry injection of ofloxacin. Ofloxacin, 100 mg (sieved through fine sieve), lignocaine hydrochloride, 250 mg (sieved through fine sieve), niacinamide, 125 mg (sieved through fine sieve), PEG4000, 375 mg (fine powder), sodium benzoate, 250 mg (sieved through fine sieve) are kept in a 5 mL vial. When 5 mL distilled water is added in the vial and vial is shaken vigorously, a clear solution is obtained. This experiment explains that a dry injection of poorly water-soluble drug, ofloxacin, can be developed using solubilizing power of all five solid solubilizers. Chemical stability studies and toxicological studies shall have to be performed to develop a dry injection for reconstitution of ofloxacin. All materials used in this formula should be free from pyrogens and microbes. Containers should be sterile and aseptic room shall be employed during its manufacture.

### CONCLUSION

Mixed solvency concept can further be utilized for development of dry injections as well as dry syrups of various poorly water-soluble drugs. In above research work, it is important to note that drug selected is a model drug and solubilizers are model solubilizers. Formulations of various insoluble drugs can be developed using mixed solvency technique. Similarly, several combinations of safely used additives may be used to make innumerable safe blends giving enhanced solubilities of poorly soluble drugs.

### REFERENCES

Lung cancer is more prone to metastasis at its early stages. Treatment of lung cancer through nasal route is very specific way of drug delivery. Surface modification is other way to targeted drug delivery.

MATERIALS AND METHODS

Etoposide was obtained as a gift sample from United Biotech (P) Ltd., New Delhi, India. Soya phosphatidylcholine (PC), cholesterol (Chol), stearylamine (SA), mannose, sephadex G-50, Triton X-100, and phosphotungstic acid were purchased from Jay appliances. Chloroform and all other chemicals used were of pure analytical grade and obtained from Qualigens, Mumbai, India.

Preparation of surface functionalized liposomes containing etoposide

Multilamellar vesicles containing etoposide was prepared as PC and cholesterol were dissolved in the minimum amount of chloroform:methanol (2:1) mixture in round bottom flask and then methanolic solution (80 µg/mL) of etoposide with minimum amount of dimethyl sulfoxide was added to it. The organic solvent mixture was removed using a rotary flash evaporator (Stereo glass Rotavap, Italy) under reduced pressure. The dried film was hydrated with 10 mL of PBS (pH 7.4) followed by continuous vortexing of the flask for about an hour to get multilamellar liposomes. Liposomal suspension was allowed to stand for further 3–4 h in the dark at room temperature to allow complete swelling of the vesicles. The suspension was then centrifuged at 2000 rpm for 4 h, and the pellet was resuspended in PBS (pH 7.4).

Formulation of mannosylated vesicles

The attachment of mannose to etoposide bearing multilamellar liposomes was performed using the method described by Jain et al., 2008. The method involves ring opening of mannose followed by reaction of its aldehyde group with free amino groups present over the surface of prepared liposomes. Mannose was dissolved in 0.1 M sodium acetate buffer (pH 4.0). This solution was then added to liposomes, agitated, and allowed to stand at ambient temperatures for 2 days. The resulting solution was concentrated under vacuum at 50°C. Mannosylated liposomes were purified by dialyzing against double-distilled water in a dialysis tube (12 kDa; HiMedia, India) for 24 h to remove unreacted mannose [Figure 1].

CHARACTERIZATION OF COUPLED LIPOSOMES

The presence of mannose residues on the surface of liposomes was detected by agglutination of the vesicles with concanavalin A. Coupling of mannose on surface was also

Address for correspondence:
Neelima Salvi, Department of Pharmaceutical Sciences, Dr. Hari Singh Gour Vishwavidyalaya, Sagar, Madhya Pradesh, India. E-mail: salvi.neelima@gmail.com
detected by the IR spectroscopy of the coupled and uncoupled formulations.

The morphological studies exhibited that the uncoupled and coupled liposomes are spherical in shape as it can be clearly seen by transmission electron microscopy.

The *in vitro* drug release profile of entrapped etoposide from different coupled and uncoupled liposomal formulation was studied using dialysis tube. The percent drug release from coupled and uncoupled liposomal formulation was calculated at different intervals in PBS (pH 7.4). The percentage drug release from cationic formulations was 4.9 at an interval of 2 h and, 45.7% at an interval of 24 h. The mannose coupled liposomes show 3.9% and 41.9% drug release in 2 h and 24 h, respectively. The reduction in drug release for the coupled formulations as compared to the uncoupled is due to the enhancement of membrane integrity and the layer of the mannose on the liposomal surface [Figure 2].

**Stability studies**

The stability study on prepared formulation was performed by storing the formulation at low temperature that is 4°C and room temperature 37 ± 1°C for 30 days and formulations were assessed periodically for the change in vesicle size, number of vesicles and residual drug content. It indicates that formulations stored at 4°C were more stable as compared to those stored at 37 ± 1°C.

**CONCLUSION**

Higher lung drug concentration was recorded in case of ligand-anchored liposomes as compared to plain drug solution and plain liposomes. These results suggest that the ligand-anchored liposomes are not only effective in rapid attainment of high drug concentration in lungs and but also maintain the same over prolonged period of time.

**REFERENCE**

INTRODUCTION

Cancer is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body. The shorter half-life of the drug in systemic circulation increases the frequency of its administration. Developing a parenteral controlled slow release formulation is, therefore, essential to reduce the frequency of administration of cisplatin. Incorporation of the drug in vesicular bodies is a usually adopted strategy for parenteral slow release formulation.

Erythrocytes can be used as carriers in two ways: Targeting particular tissue/organ and for continuous or prolonged release of drugs. Carrier red blood cells (RBC) have proved to be useful for a variety of in vitro tests. The most frequent in vitro application of RBC mediated microinjection. Nowadays, there are numerous applications have been proposed for the use of resealed erythrocytes as carrier for drugs, enzyme replacement therapy, etc.[1,2]

METHODS

Cisplatin is obtained as gift sample from Intas Pharmaceuticals Ltd. Ahmedabad. Moreover, all other chemicals used in this study are of analytical reagent grade.

Collection of erythrocytes

RBC was collected from the blood bank of Rajratan Hospital, Indore. The institution has an informed consent form from donors that their blood can be used for biomedical research.

Method of hypotonic pre-swelling and isotonic resealing

4 mL erythrocyte suspension was centrifuged at 2000 rpm for 5 min at 4°C. From 4 mL suspension about 2 mL packed cell obtained. To this packed cell 0.65% NaCl was added and mixed gently which was further centrifuged at 650 rpm for 5 min at 4°C. The supernatant obtained was discarded and swollen cells were collected. To this swollen cell, 100 μL of (mg/mL) drug solution was added. Drug solution was further added up to the point of cell lysis. The sample was observed under oil immersion microscope. Now 4 mL of 1.1 g percentage of NaCl solution was added and cells were washed with PBS 7.4.

Characterization of cisplatin-loaded resealed erythrocytes

Morphological examination

Drug-loaded erythrocytes were observed under oil immersion lens using optical microscope [Figure 1 and 2].
Encapsulation efficiency

To determine encapsulation efficiency, the RBC membrane was deproteinized using acetonitrile followed by centrifugation. 1 mL of the supernatant was pipetted out and drug content was determined using ultraviolet (UV)-visible spectrophotometer at 203 nm and encapsulation efficiency was determined.

\[
\text{Encapsulation efficiency} = \frac{\text{Encapsulated drug}}{\text{Total drug}} \times 100
\]

Osmotic fragility test

Osmotic fragility test was carried out on loaded erythrocytes. For this, a series of concentration of sodium chloride ranging from 0.1% to 0.9% w/v was prepared. A drop of the loaded erythrocytes was added separately to different concentrations of sodium chloride taken in test tube. The supernatant was analyzed spectrophotometrically for hemoglobin leakage. Osmotic fragility curve was then constructed by plotting concentration of sodium chloride and for loaded erythrocyte.

In vitro drug release

0.5 mL of loaded erythrocytes suspension in phosphate buffer pH 7.4 maintained at 4°C was taken in a hard glass tube. Measured amount of fluid from the beaker was removed periodically and replaced by same amount of fresh fluid. Analysis of drug is carried out by UV spectrophotometer.

Percent cell recovery

It can be determined by counting the number of intact cells per cubic mm of packed erythrocytes before and after loading of the drug. It was examined under microscope and number of intact cells with the help of Neubauer chamber.

RESULTS AND DISCUSSION

A gentle loading method based on hypotonic hemolysis, isotonic resealing and annealing were employed for the encapsulation of cisplatin in erythrocytes. Saline solution (0.65%) was used for swelling of the erythrocytes (no visible hemolysis was observed at this concentration). swollen erythrocytes were brought to the point of lysis by addition of the drug solution. This point was observed microscopically. Encapsulation efficiency of cisplatin-loaded erythrocytes was found to be 14.8%. Optical microscopic examination of loaded cells revealed no difference in the morphological characteristics when compared to normal cells. Osmotic fragility of loaded cells is higher than that of normal cells when cells are kept at various concentrations from 0.1% to 0.9%. In vitro release profile of encapsulated cisplatin is shown in Figure 3. Drug was slowly released over a period of 24 h and was analyzed by UV spectrophotometer.
CONCLUSION

The use of resealed erythrocytes looks promising for a safe and sure delivery of various drugs for passive and active targeting. The study retards the release of cisplatin by encapsulating in carrier erythrocyte. However, the concept needs further optimization to become a routine drug delivery system.

REFERENCES

INTRODUCTION

Liposomes are spherical nanosized vesicles composed of natural phospholipids and cholesterol. Liposomes have shown their potential as an excellent drug delivery system against cancer. The basic problem with anticancer drug-loaded conventional liposomal formulation is that normal tissues are also get affected by drug. To reduce the side effects associated with anticancer drugs, calcein (CAL) encapsulated liposomes (REV) carrying photoactive destabilization agent ketoprofen in the lipid bilayer were formulated. Effect of ultraviolet (UV) radiation activation of liposomal membrane incorporated ketoprofen on the destabilization of the liposome bilayer and the release of encapsulated CAL were investigated. Liposomes of phosphatidylcholine (PC):cholesterol (CHOL) in 7:3 molar ratio, and photoactive liposomes of phosphatidylcholine (PC):cholesterol (CHOL): ketoprofen, in 7:3:2 molar ratio were formulated. Size, CAL encapsulation efficiency (EE (%), and in vitro release were studied. Due to the incorporation of ketoprofen in the liposomal membrane, approximately 5% increase in the EE (37%) in comparison to standard liposomes (32%) was observed. Size of different liposomal formulations was found to be in nano range from 200 to 400 nm. Exposure to UV radiation resulted in the release of CAL and in 15 h 99% of entrapped CAL was released from photosensitive liposome and only 65% in case of standard liposome in the same time. We found that it could be considered as an excellent nano-sized system for delivery of anticancer agents.

MATERIALS AND METHODS

Preparation of photosensitive liposomes

Liposomes were formulated by REV method. Principal constituents of the vesicles phosphatidylcholine, cholesterol, and ketoprofen in different molar ratios were dissolved in minimum amount of chloroform and flask was rotated to prepare a thin uniform film along with removal of chloroform.[1] Fluorescent model drug calcein (CAL) (3 mL, 0.4 mM in 0.05 M, pH 7.4 PBS) was added into round bottom flask as the aqueous phase.[2,3]

Spectrofluorimetric determination of CAL

The amount of CAL was determined spectrofluorimetrically (Shimadzu Spectrofluorimeter, Japan, Model RF-5000) by measuring the fluorescence intensity (FI) at an excitation wavelength (λex) of 494 nm and an emission wavelength (λem) of 517 nm. Calibration curve for CAL (FI vs. concentration) was also constructed.[4]

Determination of CAL entrapment efficiency of liposomes

For the EE (%) determinations of CAL-loaded liposomes, liposome encapsulated and free CAL were separated. The amount of CAL in each eluate was determined spectrofluorimetrically using the FI value and the calibration curve.[5]

Key words: Ketoprofen, liposome, photosensitive, triggered release

Address for correspondence:
N. K. Sharma, IPS Academy College of Pharmacy, Indore, Madhya Pradesh, India.
E-mail neerajsharma236@gmail.com
Effect of UV radiation exposure duration on CAL release from liposomes

Effect of UV radiation exposure duration on in vitro CAL release from both the conventional and the photosensitive liposomes was examined [Figure 1].

RESULTS AND DISCUSSION

Liposomes of phosphatidylcholine (PC):cholesterol (CHOL) in 7:3 molar ratio, and photoactive liposomes of phosphatidylcholine (PC):cholesterol (CHOL):ketoprofen, in 7:3:2 molar ratio were formulated. Size, CAL encapsulation efficiency (EE [%]), and in vitro release were studied. Due to the incorporation of ketoprofen in the liposomal membrane, approximately 5% increase in the EE (37%) in comparison to standard liposomes (32%) was observed. Size of different liposomal formulations was found to be in nano range from 200 to 400 nm. Exposure to UV radiation resulted in the release of CAL and in 15 h 99% of entrapped CAL was released from photosensitive liposome and only 65% in case of conventional liposome in the same time.

CONCLUSION

The destabilizing effect of UV exposure was more pronounced in the photosensitive liposomes. With this study, it was thus possible to achieve local delivery of bioactive agents like anticancer through incorporation of ketoprofen into the liposomal bilayer followed by destabilization by UV exposure. With this in vitro study, it is established to achieve triggered release of encapsulated drug through incorporation of ketoprofen. We believe that it could be considered as a system for triggered delivery of bioactive agents in vitro and in vivo.

REFERENCES

INTRODUCTION

Oxidative stress is shown to be responsible for various diseases including atherosclerosis, Alzheimer disease, Parkinson’s disease, cancer, diabetes mellitus, inflammatory diseases, as well as psychological diseases or aging processes. To avoid these types of complications, antioxidants are widely used around the world, and there is an increase the demand for the development of new antioxidants from natural and synthetic sources. The present work aims to study the binding of benzohydrazone derivatives on tyrosinase enzyme with the help of molecular docking.

MATERIALS AND METHODS

A series of 30 benzohydrazone derivatives displaying promising antioxidant activity in FRAP assay was used for docking on crystal structure of mushroom tyrosinase (PDB ID: 2Y9X). The docking analysis was carried out on Molegro Virtual Docker (Version 5.0).

EXPERIMENTAL

Docking was implemented to find the probable binding interactions between the title compounds and the enzyme. The protein was retrieved from RCSB protein data bank. Water molecules and cofactors in the structure were removed from the protein and hydrogens were added. The cocrystallized ligand tropolone (chain A) interactions’ (Ser 282, Gly 281, Ala 286, Val 283, His 296, Met 280, Gly 281, Phe 264, Asn 260, His 263, and His 259) were selected as active site interactions. After docking simulation of title compounds and kojic acid, the generated poses were sorted on the basis of their MolDock scores [Table 1].

RESULTS AND DISCUSSION

The docked conformation of the IP7 into the active site of the enzyme revealed hydrogen bond interactions between phenolic hydroxyl groups of IP7 with His85, His263, and Met280 of tyrosinase. The hydrogen of hydroxyl group at para position and oxygen of 3-OH and 5-OH group of benzohydrazone phenyl ring served as hydrogen bond acceptor and donor by forming hydrogen bond with His 263, His 85, and Met 280, respectively [Figure 1].

CONCLUSION

Hydrogen bond interaction of the phenolic hydroxyl group to the active site amino acids His85, His263, and Met280 suggested the requirement of electron-donating groups.
### Table 1: Dock score of benzohydrazone derivatives

<table>
<thead>
<tr>
<th>Comp ID</th>
<th>R</th>
<th>MolDock Score (kcal/mol)</th>
<th>Comp ID</th>
<th>R</th>
<th>MolDock Score (kcal/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP1</td>
<td>2-hydroxy-5-methoxyphenyl</td>
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<td>IP16</td>
<td>4-fluorophenyl</td>
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<td>IP2</td>
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<td>2,5-Dimethoxyphenyl</td>
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<tr>
<td>IP3</td>
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<td>IP18</td>
<td>Phenyl</td>
<td>-105.76</td>
</tr>
<tr>
<td>IP4</td>
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<td>IP19</td>
<td>3-Bromo-4-fluorophenyl</td>
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</tr>
<tr>
<td>IP5</td>
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<td>IP20</td>
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<td>IP6</td>
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<td>2,4,6-Trihydroxyphenyl</td>
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<td>IP7</td>
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<td>3-Bromo-4-hydroxyphenyl</td>
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<td>4-Chlorophenyl</td>
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<td>IP10</td>
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<td>IP25</td>
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<td>IP11</td>
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<td>4-Pyridyl</td>
<td>-103.107</td>
</tr>
<tr>
<td>IP12</td>
<td>methylbenzoate-4-yl</td>
<td>-133.096</td>
<td>IP27</td>
<td>4-Hydroxy-3-methoxyphenyl</td>
<td>-141.62</td>
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<tr>
<td>IP13</td>
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<td>-132.715</td>
<td>IP28</td>
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<td>IP14</td>
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<td>IP15</td>
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<td>IP30</td>
<td>3,5-Dihydroxyphenyl</td>
<td>-114.887</td>
</tr>
</tbody>
</table>

Kojic acid

---

**Figure 1:** (a and b) Docking pose of IP7 into the active site of mushroom tyrosinase
proving them to be crucial for binding as well as anti-
tyrosinase activity. Designing on the basis of molecular
docking can result in more potent analogous of this series.

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2011;50:5477-87.
Establishing Anticancerous Property of *Curcuma longa* Through Structural-based Approach

Nidhi Gupta, Love Kumar Soni

School of Pharmacy, Devi Ahilya University, Indore, Madhya Pradesh, India

Abstract

Herbal medicines are widely used as an effective therapy in the treatment of cancer since past two decades due to their enormous potential for combating the diseases. Protein tyrosine kinase (PTKs) is a key enzyme in cell signaling pathway and plays crucial role in the treatment of different types of cancer. PTKs are the enzymes, which catalyzes the transfer of the γ phosphate of ATP to tyrosine residues on protein substrates. To overcome the adverse effects of synthetic compounds, curcumin is taken as a herbal medicine for treating life-threatening disease cancer. To gain most potent and lead compound as a tyrosine kinase inhibitors, docking study has been performed on Pdb:1M17 using Molegro Virtual Docker (MVD) 6.0 software. Common amino acid bindings are observed in selected compound which exhibits similar interaction as mentioned in the pdb database. Docking study revealed that steric and H-bonding interactions play significant role against receptor tyrosine kinase enzyme for their anticancer activity. Docking score and similar amino acid binding interactions provide us an idea for designing of new lead and more potent analogs.

Key words: Anticancer activity, curcumin, docking, protein tyrosine kinase

INTRODUCTION

Cancer is a second worldwide health issues or life-threatening disease after the cardiac problems. Despite advancement in diagnosis and treatment, overall survival of patients due to cancer still remains poor. Synthetic anticancer agents or therapies are beyond the reach of common man because of cost factor, adverse effects, and serious toxicity to other organs. Hence, there is an urgent need for developing more specific and cost-effective medicine. To gain this object peoples are moving toward the herbal therapy due to their less toxic and more economic nature. Herbal medicines play key role in this context. Various herbal medicines are available nowadays for the prevention and treatment of cancer.

Curcumin, a yellow color pigment and active constituent derived from the rhizomes of the *Curcuma longa* plant belonging to family Zingiberaceae. It is commonly used as Indian spice and food coloring agent. *C. longa* has been widely used in traditional remedies for various ailments including wound healing, urinary tract infections, and liver disorders. Rather than antioxidant, anti-inflammatory activity, anticancerous property of curcumin also has been reported. Anticancer activity of curcumin has been found due to the inhibition of tyrosine- kinase receptor and also suppression of NF-κβ through the inhibition of the Akt/IKKα pathway.[1]

MATERIALS AND METHODS

The main aim of this work is to overcome the drawback of curcumin such as genotoxicity, poor water solubility, and rapid intestinal, and hepatic metabolism by employing molecular docking approach. Molecular docking is an attractive scaffold which involves the interaction of drug molecule with the receptor to give the stable product. The docking study has been performed using Molegro Virtual Docker (MVD) 6.0 software[2] by 64-bit operating system under window8 with an Intel® Celeron® Processor N2840. Reported crystal structure of tyrosine kinase enzyme inhibitor was extracted from protein data bank (pdb Id:1M17) (http://www.rcsb.org/pdb)[3] as shown in Figure 1. For docking study, both

Address for correspondence:
Nidhi Gupta, School of Pharmacy, Devi Ahilya University, Indore, Madhya Pradesh, India.
E-mail gnidhi504@gmail.com
protein and ligand molecules were optimized using standard procedure of the software, and lowest energy conformation was selected.

**RESULTS AND DISCUSSION**

The docking study has been performed to gain more fruitful structural insights toward tyrosine kinase enzyme inhibitory activity. The tyrosine kinase inhibitors represent a new class of therapies for cancer and other proliferative diseases. To validate the accuracy of docking procedure root square mean deviation (RMSD) ≤2.0Å from the cocrystallized ligand during experimentation, the used scoring function is successful. The RMSD value has been found 1.90Å when compared with it cocrystallized ligand. Docking analysis reveals that docked compound exhibits approximately similar amino acid interaction as mentioned in the pdb database shown in Figure 2.

Docking score or the highest binding affinities, i.e., lowest free energy of docked compound and hydrogen bonding interactions are represented in Tables 1 and 2. The surface of EGFR tyrosine kinase receptor is mainly hydrophobic, and it shows mainly hydrophobic interaction and also exhibits hydrogen bond interaction with Met769 residue of receptor.

**CONCLUSION**

Antitumor activity of curcumin has been predicted on the basis of molecular docking simulation study. This study revealed that hydrophobic interaction plays crucial role for their inhibitory activity because there surface is also hydrophobic. It interacts with leu768, leu820, and gly772 residue through hydrophobic bond and Met769, Gln767, Glu738, and Lys721 through hydrogen bond with tyrosine kinase receptor. The curcumin makes 5 hydrogen bond with receptor whereas bond-length as similar 2.63Å which is exhibited by cocrystallized ligand in docking study. These

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**Figure 1:** 2D view of receptor tyrosine kinase inhibitors pdb code: 1M17 and their interactions are shown

**Figure 2:** (a and b) The docking interaction between curcumin and receptor is shown. Blue color indicates hydrogen bonding interactions, and red color shows steric interaction

| Table 1: Docking score and number of hydrogen bonds with tyrosine kinase receptors of cocrystallized ligand and docked ligand |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Ligand** | **Mol dock score** | **Rerank score** | **H-bond** | **Number of H-bonds** |
| Cocrystralized ligand (AQ4) | −127.74 | −103.78 | −2.50 | 1 |
| Curcumin | −120.65 | −86.64 | −9.17 | 5 |

| Table 2: Hydrogen bond and steric interaction of cocrystallized ligand and docked ligand |
|-----------------|-----------------|-----------------|-----------------|
| **Ligand** | **H-Bond interaction** | **Steric interaction** |
| Cocrystralized ligand (AQ4) | Met769 | Met769, Leu768, Leu694, Leu820, Gly772 |
| Curcumin | Met769, Gln767, Glu738, Lys721 | Leu768, Leu820, Asp831, val702, Gly772 |
findings suggested that if we design the derivatives of curcumin by modifying its structure, it could have been a more potent and lead molecule for treatment of cancer.

ACKNOWLEDGMENT

Author (NG) is grateful to the Department of Science and Technology (DST) - Innovation in Science Pursuit for Inspired Research (INSPIRE) for providing DST-INSPIRE fellowship and also thankful to the Head, Department of School of Pharmacy for providing necessary facilities to carry out the work.

REFERENCES

Pyrazolopyridine as a Potential Inhibitor of Epidermal Growth Factor Receptor as Anti-lung Cancer Agent: Molecular Modeling Approach

K. Kapoor¹, N. Dhingra²

¹School of Pharmacy, Devi Ahilya University, Takshashila Campus, Indore, Madhya Pradesh, India, ²Institute of Science, SAGE University, Kailod Kartal, Indore, Madhya Pradesh, India

Abstract

Lung cancer is one of the most prevailing disorders in India. Annually about 1.2 million patients get affected form it, and there is rise in these numbers. Epidermal growth factor receptors (EGFR) are stimulated by epidermal growth factor which causes cell proliferation, cell differentiation, etc., which leads to cancer, including lung cancer. Molecular docking study and pharmacophore mapping were performed on 76 pyrazolopyridine derivatives. Compound PYRA-43 binds to the active site of EGFR tyrosine kinase with highest MolDock score of −168.179 and re rank score of −116.138. PYRA-43 binds to the active amino acid MET-793 and LYS-745 within the active site of protein. Pharmacophore mapping showed that the most active compound has 5 H-acceptors, 3 H-donors, 37 steric interactions, and 28 aromatic ring molecules were found. The given study could be helpful in designing the novel compounds for the treatment of lung cancer as EGFR tyrosine kinase inhibitor.

Key words: Lung Cancer, docking, EGFR

INTRODUCTION

Objective of the given work is to identify more potent and highly effective novel compound for the treatment of lung cancer, which could be further used as a therapeutic agent in treating lung cancer.

MATERIALS AND METHODS

Molecular Docking: Molecular docking was performed by Molegro Virtual Docker 6.0 on EGFR tyrosine kinase protein with PDB code 5 HIB² which was retrieved from protein data bank. Active amino acids according to the literature which form hydrogen bonds are Lys-745 and Met-793 and hydrophobic bonds are Asp-885, Ala-743, Leu-844, and Val-726.

Further, Pharmacophore mapping was done on the most active compound for the detection of H-acceptors, H-donors, steric interactions, and aromatic ring structure present in the most active compound.³

RESULTS AND DISCUSSION

Molecular docking

Molecular docking results revealed that most active compound PYRA-43 bind to the active site of the ligand. It binds to the active amino acid Met-793 and Lys-745 with similar distance as of ligand incorporated in the protein [Figure 1a]. The MolDock score was found to be −168.179 for the compound. Afterward, pharmacophore mapping was done on the most active compound, and it was found that it has 5 hydrogen acceptors, 3 hydrogen acceptors, and 37 steric interactions [Figure 1b and Tables 1 and 2].

CONCLUSION

The given study is valuable, inexpensive and important for further in vitro and in vivo studies. Selected pyrazolopyridine analogs can be studied for their therapeutic potential in treating lung cancer.

Address for correspondence:
K. Kapoor, School of Pharmacy, Devi Ahilya University, Takshashila Campus, Indore, Madhya Pradesh, India.
E-mail: kapish11.kk@gmail.com
ACKNOWLEDGMENTS

We would like to thank Prof. Rajesh Sharma Head, School of Pharmacy, DAVV, Indore, for providing the facility for the work. We would also like to thank Mr. Naveen Dhingra for guidance on this topic.

Table 1: MolDock, re rank, and h-bond interaction of top five compounds

<table>
<thead>
<tr>
<th>Compound name</th>
<th>MolDock score</th>
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<th>H-bond interaction</th>
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<td>Pyra-50</td>
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<td>Pyra-47</td>
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<td>Pyra-29</td>
<td>-137.85</td>
<td>-101.103</td>
<td>-1.81704</td>
</tr>
</tbody>
</table>

Table 2: Comparison of amino acids of cocrystallized ligand and most active compound

<table>
<thead>
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<th>Ligand/compound name</th>
<th>H-bond interactions</th>
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</thead>
<tbody>
<tr>
<td>[63M] 1101 A</td>
<td>Met-793, Lys-745</td>
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<tr>
<td>PYRA-43</td>
<td>Met-793, Lys-745</td>
</tr>
</tbody>
</table>

REFERENCES

Molecular Docking Study of Chalcones as Antibacterial Agents

Shikha Sharma, Kapish Kapoor

School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Campus, Indore, Madhya Pradesh, India

Abstract

Antibacterial is those agents that decimate bacteria or suppress the growth of bacteria or reduce the ability to reproduce. Chalcone is an aromatic ketone and an enone. In the given study, molecular docking study was performed on 31 chalcone derivatives as an antibacterial agent. In the molecular docking study pdb code: 5EZP was used and the molecular docking study result revealed that most active compound was found to be chal-20, which actively binds to the active side of protein with amino acid Lys 15 and the MolDock score was found to be −158.6. The molecular docking was done on Molegro Virtual Docker (version 6.0). By the above study performed, these compounds can be used further for in vitro and in vivo studies.

Key words: Antibacterial, Molecular docking, Chalcone

INTRODUCTION

Antibacterial is those agents which diminish the growth and reproduction of bacteria. Antibacterial and antibiotics both attack on bacteria, but antibacterial agents are used to disinfect surface and eradicate potentially harmful bacteria. Unlike antibiotics not used as medicines but found in products such as soaps and skincare products. Alcohols, chlorine, peroxides, and aldehydes are the common antibacterial agents they rapidly destroy bacteria and leave no active residue behind so quickly disappeared. Chalcone derivatives are the residue producing that leave long-acting residues on the surface to be disinfected and thus have prolonged action.

Mechanism of action of antibacterial agent generally falls within one of four mechanisms:
• Inhibition of enzyme
• Interfere with cell wall synthesis
• Interfere with DNA synthesis
• Interfere with protein synthesis.

Chalcones are open chain flavonoid in which two aromatic rings are joined by a three carbon α-β carbonyl-carbonyl system that is 1,3-diphenyl-2-propene-1-one derivatives. Antibacterial activity of chalcones mainly attributed due to the presence of phenolic hydroxyl group which has high affinity for proteins and thus may inhibit microbial enzymes.\(^1\)

MATERIALS AND METHODS

In this molecular docking study of chalcone derivatives, 31 chalcone derivatives were taken, and their energy minimization was done using chem3d ultra 8.0. Moreover, pdb 5EZP was used for the binding of the molecules, after that molecular docking is done by using the software Molegro Virtual Docker (version 6.0).

RESULTS

Out of 31 chalcone derivatives, compound Chal-20 showed best interaction with active site of protein with amino acid Lys 15. With the MolDock score −158.61 which revealed that chal-20 has potential an antibacterial activity and it can be used for further in vitro and in vivo study.

Figure 1 shows interactions of the most active compound with the protein and protein.

CONCLUSION

The given study is valuable, inexpensive and important for further in vitro and in vivo studies. Selected chalcones

Address for correspondence:
Shikha Sharma, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Campus, Indore, Madhya Pradesh, India. E-mail: sharmashikha1293@gmail.com
analogs can be studied for their therapeutic potential in treating antibacterial diseases.

**ACKNOWLEDGMENTS**

We would like to thank Prof. Rajesh Sharma Head, School of Pharmacy, DAVV, Indore, for providing the facility for the work.

### REFERENCES


INTRODUCTION

In cancer cells the normal control systems that prevent cell overgrowth and the invasion of other tissues are disabled. These altered cells divide and grow in the presence of signals that normally inhibit cell growth; therefore, they no longer require special signals to induce cell growth and division.

Colon cancer happens when tumors grow develop in the large intestine. 5-fluorouracil cyramza, cetuximab, etc., or the combination of such type of drugs is used to treat these type of cancer.\(^1\)\(^-\)\(^3\)

Objective

The objective is to provide a more therapeutically active and potent drug for treatment of colon cancer.

METHOD

23 spiropyrazoline oxindole was taken, and energy minimization was done using chemdraw ultra 3D 8.0; thereafter, molecular docking was performed using molegro 6.0. Docking was performed using protein pdb code 2hq6. After docking top results are taken and further shortlisted for highest MolDock score.

RESULTS

After docking compound number 13 gave highest MolDock score, i.e., \(-125.742\). Re rank score obtained was found to be \(-70.4163\), and hydrogen bonding was found to be \(-3.22746\). The most active site of drug was bind to Asn103 and protein PDB code is 2hq6. This compound can be further used for \textit{in vitro} and \textit{in vivo} study.

Key words: Spiropyrazoline oxindoles, Colon cancer, Molecular docking

Table 1: Score comparison of the top 3 compounds

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<td>(-85.4549)</td>
<td>0.0334028</td>
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<tr>
<td>OXY-1</td>
<td>(-118.219)</td>
<td>(-72.3526)</td>
<td>(-2.89104)</td>
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Address for correspondence:
Shubham Patel, School of Pharmacy, Devi Ahilya Vishwavidyalaya Takshashila Campus, Indore, Madhya Pradesh, India. E-mail: pshubhamatel@gmail.com
ACKNOWLEDGMENT

We would like to thank Mr. Rajesh Sharma, head of the Department School of Pharmacy, DAVV, Indore, for proving us the facility for the work and a special thanks to our fellow classmates for providing the support for this work.

REFERENCES

Molecular Docking Study of 2,4,5 Trisubstituted Imidazole Analogues as Braf Kinase Inhibitors

Jasdev Tuteja, M. C. Sharma

School of Pharmacy, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India

Abstract

In the present study, docking was performed on 2,4,5 trisubstituted imidazole with naphthyl and benzothiophene 4-substitutents as BRAF Kinase Inhibitors using software Molegro 6.0. The information obtained by the study can be used to make more potent and selective inhibitors of BRAF Kinase. The docking was performed using the PDB -4MBJ (i.e. B-RaF Kinase Complex with an imidazopyridine-based inhibitor) where the most active compound showed the hydrogen bond interaction with amino acid Gly-596 which was congruent with that of PDB.

Key words: BRAF Kinase, 4MBJ, Docking, Molegro

INTRODUCTION

The serine threonine kinase BRAF is a member of the RAF kinase family, which is part of the RAF/MEK/ERK serine threonine kinase cascade. This kinase cascade also called the ERK/MAP kinase pathway (or “classical” MAPK pathway), regulates cell growth, survival, and differentiation.[1] Triaryl substituted imidazole-based compounds are the most potent mutant BRAF inhibitors within its series. Compounds containing 2,4,5-trisubstituted, five-membered, aromatic heterocycles have been reported previously as potent inhibitors of BRAF, targeting the active conformation of the kinase.[2]

EXPERIMENTAL METHODS

ChemDraw Ultra 8.0 was used for the sketching of the molecules with the help of drawing tools in the software. The sketched 2D structures are transformed into 3D structures using module of the program followed by energy minimization. The docking studies were performed using Molegro Virtual Docker 6.0. Docking was performed on,[3] mol format saved structures using the PDB 4MBJ which was procured from RCSB website as per the docking wizard. Results were interpreted and tabulated.

RESULTS AND DISCUSSION

The docking study performed gave MolDock score of Compound 2 to be highest being −168.903. Other high docking values are tabulated below:

<table>
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<th>Compound number</th>
<th>MolDock score</th>
<th>Re rank score</th>
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<td>2</td>
<td>−168.903</td>
<td>−62.6499</td>
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<tr>
<td>5</td>
<td>−165.231</td>
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</tr>
<tr>
<td>8</td>
<td>−164.637</td>
<td>−122.947</td>
</tr>
</tbody>
</table>

Figure 1: Protein Structure

Address for correspondence:
Jasdev Tuteja, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India. E-mail: jasdevtuteja@gmail.com
Furthermore, the interaction that matched with PDB 4MBJ downloaded from RCSB was Gly-596 as is sited in Figures 1 and 2.

CONCLUSION

The compound number 2 showed that it was found to be highly potent to inhibit BRaF Kinase enzyme and it can be further used for *in vitro* and *in vivo* studies.

REFERENCES

Docking Studies of Pyrano[3,2-A] Phenazine Hybrid Molecules as Antitumor Agent

Shikha Nagle

School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Campus, Indore, Madhya Pradesh, India

Abstract

Cancer cells the normal control systems that prevent cell overgrowth and the invasion of other tissues are disabled. These altered cell division and growth in the presence of signals and produce tumor, a tumor is a lump or growth of tissue made up from abnormal cells. The molecular modeling analysis was performed on 30 poly-substituted pyrano[3,2-a]phenazine derivatives for antitumor activity, their biological activities were taken from the previous designed compounds favors active site binding in various amino acid residues Arg48, Ser40, Thr266, Ser41, Ala66, Val252, Glu40, Ser18, Ile477, Arg68, and Met67 in binding pocket of previously generated protocol of PDB code: 3X0V.

Key words: Anticancer, molecular docking, PDB-3X0V

INTRODUCTION

Molecular hybridization is not only a rational design strategy employed for the synthesis of antitumor agents but also a well-established strategy to produce novel hybrid molecules with improved affinity and efficacy compared to the parent drugs. In cancer cells, the normal control systems that prevent cell overgrowth and the invasion of other tissues are disabled. These altered cells divide and grow in the presence of signals that normally inhibit cell growth; therefore, they no longer require special signals to induce cell growth and division. A tumor is a lump or growth of tissue made up from abnormal cells. Tumors are divided into two types: Benign and malignant. The root cause of cancer is alteration in genes, i.e., mutation.

Objective

Molecular docking of pyrano[3,2-a]phenazine using PDB:3X0V studied to identify best interactions of ligand and protein to give more potent and more therapeutically active compound. Evaluation of the docking result was based on protein-ligand complementarity considering steric and electrosteric properties.

EXPERIMENTAL METHOD

In the current study, molecular modeling analysis was performed on 30 poly-substituted pyrano[3,2-a]phenazine derivatives with their biological activities were taken from the previous designed compounds favors active site binding in various amino acid residues Arg48, Ser40, Thr266, Ser41, Ala66, Val252, Glu40, Ser18, Ile477, Arg68, and Met67 in binding pocket of previously generated protocol of PDB: 3X0V [Figure 1].

RESULTS AND DISCONNECTION

All of the compounds as well as designed compounds show similar interaction with reported ligand interaction. Binding of compounds with similar amino acids as
of PDB ligand (UN4) confirms active binding to the receptor. Docking scores give an idea about the energy [Table 1].

**REFERENCES**


INTRODUCTION

1,3,4-oxadiazole is widely used in pharmaceutical research to develop active drug substances. Among the heterocycles, 1,3,4-oxadiazole is the most important class in synthetic medicinal chemistry having diversified biological application such as antimicrobial\(^\text{[1]}\), anti-HIV\(^\text{[2]}\), anthelmintic\(^\text{[3]}\), anticancer\(^\text{[4]}\), anticonvulsant\(^\text{[5]}\), antiviral\(^\text{[6]}\), hypoglycemic\(^\text{[7]}\), anti-inflammatory\(^\text{[8]}\), analgesic\(^\text{[9]}\), and antitubercular\(^\text{[10]}\). Now, we have synthesized 1,3,4-oxadiazole derivatives derived from aspirin and characterized with spectral analysis.

RESULTS AND DISCUSSION

Synthetic studies

The scheme of the synthesis outlined as Scheme I. The methyl ester of aspirin (I) was synthesized by esterification of aspirin. The reaction of ester I with hydrazine hydrate yielded the carbohydrazide (II). 1,3,4-Oxadiazole moiety (III) was prepared by cyclization of hydrazide. The title compounds IVa-d were prepared by the reaction of (III) with various amines and formaldehyde with good yield.

Spectral studies

Spectral studies: The structure of different synthesized compounds was confirmed by different chromatographic and spectral studies. The IR and 1H-NMR spectral data are given in the experimental protocols.

EXPERIMENTAL

The scheme of the synthesis outlined as under.

Synthesis of methyl ester of aspirin (I)\(^\text{[11]}\)

M.P. 152-154°C, yield: 76.43%. IR Spectra showed bands at 3082(C-H), 1730(C=O), 1238(C-O-C). 1H NMR chemical shift at (CDCl\(_3\), δ ppm): 11.65 (s, 1H of COOH), 7.93-7.12 (m, 4H, Ar), 2.45 (s, 3H of CH\(_3\)).

Synthesis of carbohydrazide (II)\(^\text{[12]}\)

M.P. 164–166°C, yield: 75%. IR spectra showed bands at 3325(N-H), 3022(C-H), and 1637(C=O). 1H NMR chemical shift at (CDCl\(_3\), δ ppm): 7.45 (s, 1H of CONH), 7.45–7.02 (m, 4H, Ar), 4.15 (s, 2H of NH\(_2\)), 2.35 (s, 3H of CH\(_3\)).

Synthesis of 1,3,4-oxadiazole moiety (III)\(^\text{[12]}\)

M.P. 182–184°C, yield: 72.68%. IR Spectra showed bands at 3373 (N-H), 3086 (C-H), 1577 (C-N), and 1162 (C=S). 1H NMR chemical shift at (CDCl\(_3\), δ ppm): 10.85 (s, 1H, N-H of 1,3,4-oxadiazole), 8.15–7.82 (m, 4H, Ar), 2.73 (s, 3H of CH\(_3\)).

Address for correspondence:
Anuj Singhai, Oriental College of Pharmacy and Research, Oriental University, Indore, Madhya Pradesh, India. E-mail: anujsinghai1989@gmail.com
Synthesis of oxadiazole derivatives (IV)\[13\]

Synthesis of oxadiazole derivatives (IVA)
R = Morpholine: M.P.208–210°C, yield: 73.78%. IR spectra showed bands at 3325 (N-H), 3068 (C-H), 1576 (C=N), 1511 (C=C), 1312 (C=S), and 1249 (C-O-C). 1H NMR chemical shift at (CDCl$_3$, δ ppm): 8.10–7.82 (m, 4H, Ar), 2.85 (s, 3H of CH$_3$), 4.83 (s, 2H, N-CH$_2$-N), 3.58–3.65 (t, 4H, morpholine), 2.69–2.76 (t, 4H, morpholine).

Synthesis of oxadiazole derivatives (IVB)
R = N-methyl piperazine: M.P.188–190°C, yield: 74.78%. IR spectra showed bands at 3324 (N-H), 2938 (C-H), 1578 (C=N), 1504 (C=C), and 1288 (C=S). 1H NMR chemical shift at (CDCl$_3$, δ ppm): 8.18–7.62 (m, 4H, Ar), 2.65 (s, 3H of CH$_3$), 4.63 (s, 2H, N-CH$_2$-N), 2.43 (s, 3H, CH$_3$), 2.32–2.77 (t, 4H, piperazine), 2.59–2.32 (t, 4H, piperazine).

Synthesis of oxadiazole derivatives (IVC)
R = piperidine: M.P.158–160-210°C, yield: 72.68%. IR spectra showed bands at 3377 (N-H), 2926 (C-H), 1575 (C=N), 1505 (C=C), 1352 (C=S), and 1245 (C-O-C). 1H NMR chemical shift at (CDCl$_3$, δ ppm): 7.95–7.72 (m, 4H, Ar), 2.45 (s, 3H of CH$_3$), 4.85 (s, 2H,N-CH$_2$-N), 2.82–2.72 (t, 4H, piperidine), 1.64 (m, 2H, piperidine), 1.51–1.24 (m, 4H, piperidine).

Synthesis of oxadiazole derivatives (IVD)
R = 2-methyl piperidine: M.P.221–223°C, yield: 77.85%. IR Spectra showed bands at 3307 (N-H), 2942 (C-H), 1578 (C=N), 1507 (C=C), 1299 (C=S), and 1237 (C-O-C). 1H NMR chemical shift at (CDCl$_3$, δ ppm): 8.55–7.72 (m, 4H, Ar), 2.55 (s, 3H of CH$_3$), 4.33 (s, 2H,N-CH$_2$-N), 2.80–2.72 (m, 1H, piperidine), 1.74–1.55 (m, 6H, piperidine), 1.37–1.35 (d, 3H, 2-methyl piperidine), 1.25 (m, 2H, piperidine).

SUMMARY AND CONCLUSION
The four derivatives of 1,3,4-oxadiazole were derived from aspirin by different chemical reaction. The melting point and thin-layer chromatography were performed for check purity of the synthesized compounds. Spectral studies, i.e., FTIR and 1H NMR were performed for structure confirmation.

REFERENCES

[Scheme-1: 3.1 Synthesis of methyl ester of aspirin\[11\] (I) M.P. 152-154°C, yield 76.43%. IR Spectra showed bands at 3082(C-H), 1730(C=O), and 1238(C-O-C). 1H NMR chemical shift at (CDCl$_3$, δ ppm): 11.65 (s,1H of COOH), 7.93-7.12 (m, 4H, Ar), 2.45 (s, 3H of CH$_3$)}


INTRODUCTION

The solubility enhanced technique "Hydrotropy" is employed to raise aqueous solubility of different weakly water-soluble compound due to the presence of a large amount of additives. Sodium benzoate, sodium salicylate, niacinamide, sodium ascorbate, and urea have been employed to enhance the aqueous solubility of poorly water-soluble drugs.

The projected method utilizes solution of a non-toxic, non-volatile material, N,N-dimethyl urea which is a hydrotropic agent. The objective of the present investigation is to explore the application of hydrotropy in spectrophotometric analysis of poorly water-soluble drugs to replace organic solvents which may be costlier, toxic, and pollutant.

MATERIALS AND METHODS

Hydrochlorothiazide drug sample was supplied by Ranbaxy Laboratories Limited, Dewas as gift sample, and the tablets of hydrochlorothiazide were procured from local market. All the chemicals used were of analytical grade.

Solubility of hydrochlorothiazide was determined in distilled water and 7.5M N,N-dimethyl urea solution at 28°C ± 1°C. There was more than 17-fold improvement in the solubility of drug in 7.5M N,N-dimethyl urea solution as compared to the solubility in distilled water.

RESULTS AND DISCUSSION

To prepare calibration curve, 100 mg of hydrochlorothiazide bulk drug was accurately weighed and transferred to a 100 mL volumetric flask. 40 mL of 7.5M N,N-dimethyl urea solution was added and drug was dissolved in this solution. After complete dissolution of drug, sufficient distilled water was used to make up the volume. This stock solution was further diluted with distilled water to get different standard solutions containing 4, 8, 12, 16, 20, and 24 mg/mL of drug. Absorbance values of these solutions were noted at 272 nm against their respective reagent blanks.

Twenty Table 1 of hydrochlorothiazide were weighed and finely powdered. Tablet powder equivalent to about 100 mg of hydrochlorothiazide was taken in a 100 mL volumetric flask. 40 mL of 7.5M N,N-dimethyl urea solution was added and the flask was shaken for about 10 min to solubilize hydrochlorothiazide from tablet powder and volume was made up to the mark with distilled water and the absorbance was observed under ultraviolet spectrophotometer at 272 nm against reagent blank.

Address for correspondence:
Devshree Gayakwad, Devi Ahilya College of Pharmacy, Indore, Madhya Pradesh, India.
E-mail: devshree.gayakwad@rediffmail.com
The mean percent drug estimated was 98.77% and 100.29% for formulation-I and formulation-II, respectively. These values are close to 100, indicating the accuracy of the proposed analytical method. Percent coefficient of variation and standard error in formulation I and II was found to be 1.951, 1.113 and 1.702, 0.986, respectively. The low values of these statistical parameters validated the method.

The values of mean percent recoveries for formulation-I and formulation-II ranged from 99.39 to 101.14, which are again close to 100. This fact, together with satisfactorily low values of statistical parameters, further validated the method.

CONCLUSION

The result revealed that the planned method of analysis, using N,N-dimethyl urea as the hydrotropic solubilizing agent is new, simple, cost-effective, environmentally friendly, safe, accurate, and reproducible. N,N-dimethyl urea and the commonly used tablet excipients did not interfere in spectrophotometric estimation. By appropriate choice of hydrotropic agents, the use of organic solvents in investigation may be discouraged to a large extent.

REFERENCES

Reversed-phase High-performance Liquid Chromatography Method for Simultaneous Estimation of Vildagliptin and Metformin in Combined Tablet Dosage Form

Nizami Tahir¹, Birendra Shrivastava², Sharma Pankaj², Ankit Mangal¹, Dwivedi Sumeet⁴

¹Department of Pharmaceutical Chemistry, School of Pharmaceutical Sciences, Jaipur National University, Jagatpura, Jaipur, Rajasthan, India, ²Department of Pharmaceutical Chemistry, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

Abstract

A simple reversed-phase high-performance liquid chromatography (RP-HPLC) method for the estimation of vildagliptin (VIL) and metformin (MET) was developed and validated using a mobile phase consisting of 2 mM phosphate buffer and methanol with pH 3.0 adjusted with orthophosphoric acid in the ratio of 65:35% v/v at a flow rate of 1ml/min and the detection was done at 293 nm. The retention time for VIL and MET was 2.1 and 5.5 min, respectively. The calibration curves were found to be linear in the range of 5–50 μg/mL (VIL) and 12.5–125 μg/mL (MET) with a correlation coefficient of 0.9998 and 0.9997, respectively. This demonstrated that the developed HPLC method was simple, linear, precise, and accurate, and could be conveniently adopted for the routine quality control analysis of VIL and MET simultaneously, from its pharmaceutical formulations.

Key words: RP-HPLC, Vildagliptin, Metformin

INTRODUCTION

Metformin hydrochloride (MET), an oral antidiabetic drug which is the first line of choice for the treatment of type 2 diabetes act primarily through its suppressive action on production of hepatic glucose it is known chemically as 3-(diaminomethylidene)-1,1-dimethyl guanidine. Vildagliptin (VDG) is an oral antihyperglycemic of the dipeptidyl peptidase-4 (DPP-4) inhibitor class. It works to competitively inhibit the enzyme DPP-4. It is chemically known as 1-[(3-hydroxyadamant-1-ylamino)acetyl]-pyrrolidine-2(S)-carbonitrile.¹²

MATERIALS AND METHODS

Apparatus

Waters 2998 Alliance high-performance liquid chromatographic (HPLC) system connected with PDA Detector 2998 and Empower2 Software. The drug analysis data were acquired and processed using Empower 2 software running under Windows XP on a Pentium PC. Pharmaceutical grade Metformin HCl and Vildagliptin were kindly supplied as a gift sample by Dr. Reddys Laboratory, Hyderabad.

Preparation and selection of mobile phase

The preliminary isocratic studies on a reverse phase C18 column with different mobile phase combination of dipotassium hydrogen phosphate buffer and methanol were studied for simultaneous estimation of both drugs. The optimal composition of mobile phase determined to be buffer: methanol (65:35 v/v) and filtered through 0.45 μ membrane filter.

Preparation of standard solution

1000 mg metformin HCl and 100 mg vildagliptin were dissolved in 100 mL of diluent (distilled water) and were

Address for correspondence:
Nizami Tahir, School of Pharmaceutical Sciences, Jaipur National University, Jagatpura, Jaipur, Rajasthan, India.
E-mail: tahirnizmi2015@gmail.com
further diluted to get stock solution of metformin HCl (1000 μg/mL) and vildagliptin (100 μg/mL). Appropriate aliquots were pipette out from the standard stock solution into a series of 10 mL volumetric flasks to get a concentration of 5, 10, 20, 30, 40, and 50 μg/mL of vildagliptin, 12.5, 25, 50, 75, 100, and 125 μg/mL of metformin and 50 μg/mL of gatifloxacin (internal standard).

**Preparation of sample solution**

Sample solution containing both the drugs was prepared by dissolving tablet powder into Diluent (Distilled water). 10 tablets were weighed separately. Powder of tablets equivalent to two tablets weight was weighed and taken in a 100 mL volumetric flask, dissolved in diluents and shaken and sonicated for about 10 min, then filtered through 0.45 μm membrane filter. The filtered solution was further diluted in the diluents to make the final concentration of working sample equivalent to 100% of target concentration.

**Development and validation of HPLC method present**

Study was conducted to obtain a new, affordable, cost-effective, and convenient method for HPLC determination of metformin HCl and vildagliptin in tablet dosage form. The experiment was carried out according to the official specifications of USP-30, ICH-1996, and Global Quality Guidelines-2002.

**System suitability**

System suitability study of the method was carried out by six replicate analysis of solution containing 100% target concentration of metformin HCL and vildagliptin. Various chromatographic parameters such as retention time, peak area, tailing factor, theoretical plates of the column, and resolution between the peaks were determined, and the method was evaluated by analyzing these parameters.

**Specificity**

To determine the specificity of the method, standard sample of metformin HCl and vildagliptin was injected first. Then, commercial product, blank and excipients solution were run in the instrument one after another.

**Linearity**

Linearity of the method was determined by constructing calibration curves. Standard solutions of metformin HCl and vildagliptin of different concentrations level (80%, 90%, 100%, 110%, and 120%) were used for this purpose.

**Accuracy (recovery studies)**

To check the degree of accuracy of the method, recovery studies were performed in triplicate by standard addition method at 50%, 100%, and 150%. Known amounts of standard metformin HCl and vildagliptin were added to pre-analyzed samples and were subjected to the proposed HPLC method. Table 2 Explains: Accuracy (recovery studies).

**Precision**

Precision was evaluated by carrying out six independent sample preparation of a single lot of formulation. The sample solution was prepared in the same manner as described in sample preparation. Percentage relative standard deviation was found to be <2% for within a day and day to day variations, which proves that method is precise.

**RESULTS AND DISCUSSION**

Results of system suitability are summarized in Table I. Six consecutive injections of the standard solution showed uniform retention time, theoretical plate count, tailing factor, and resolution for both the drugs which indicate a good system for analysis [Figure 1].

**CONCLUSION**

The new HPLC method was developed and validated for simultaneous estimation of Metformin HCl and Vildagliptin pharmaceutical dosage forms and assured the satisfactory precision and accuracy and also determining lower concentration of each drug in its solid combined dosage form by RP-HPLC method. The method was found to be simple, accurate, economical, and rapid and they can be applied for routine analysis in laboratories and are suitable for the quality control of the raw materials, formulations, and dissolution.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Metformin HCl</th>
<th>Vildagliptin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity range</td>
<td>12.5-125 μg/mL</td>
<td>50-150 μg/mL</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>1</td>
<td>0.9999</td>
</tr>
<tr>
<td>Slope</td>
<td>12511×14553</td>
<td>21406×3234</td>
</tr>
<tr>
<td>Retention time</td>
<td>2.193</td>
<td>5.576</td>
</tr>
<tr>
<td>USP plate count</td>
<td>3983</td>
<td>6362</td>
</tr>
<tr>
<td>Tailing factor</td>
<td>1.140</td>
<td>1.149</td>
</tr>
<tr>
<td>LOD</td>
<td>10 μg/mL</td>
<td>5 μg/mL</td>
</tr>
<tr>
<td>LOQ</td>
<td>25 μg/mL</td>
<td>10 μg/mL</td>
</tr>
</tbody>
</table>

LOD: Limit of detection, LOQ: Limit of quantification
Figure 1: Typical chromatogram of metformin HCl

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Concentration of std. (µg/mL)</th>
<th>Concentration of solution (µg/mL)</th>
<th>Amount found (µg/mL)</th>
<th>% Recovery</th>
<th>% RSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>10</td>
<td>19.90</td>
<td>99.50</td>
<td>0.324</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>20</td>
<td>30.14</td>
<td>100.46</td>
<td>0.687</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>30</td>
<td>40.87</td>
<td>102.17</td>
<td>0.652</td>
</tr>
</tbody>
</table>

Vildagliptin

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Concentration of std. (µg/mL)</th>
<th>Concentration of solution (µg/mL)</th>
<th>Amount found (µg/mL)</th>
<th>% Recovery</th>
<th>% RSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>25</td>
<td>49.69</td>
<td>100.53</td>
<td>0.517</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>50</td>
<td>74.82</td>
<td>99.38</td>
<td>0.674</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>75</td>
<td>99.83</td>
<td>99.83</td>
<td>0.285</td>
</tr>
</tbody>
</table>

studies and can be employed for bioequivalence studies for the same formulation.

REFERENCES


INTRODUCTION

Anemia is a condition that develops when blood lacks enough healthy red blood cells or hemoglobin. According to the WHO, anemia affects the lives of more than 2 billion people globally, accounting for over 30% of the world’s population which is the most common public health problem particularly in developing countries occurring at all stages of the lifecycle. Iron deficiency is the most common nutritional disorder in which there is a depleted and a restricted supply of iron to various tissues which become apparent. This may result in depletion of hemoglobin and iron-dependent intracellular enzymes participating in many metabolic pathways. Therefore, there is the need for proper management of micronutrient deficiencies most especially iron deficiency. Over the years, medicinal plants have been recognized to be of great importance to the health of individuals and communities. In many developing countries, herbal medicines are assuming greater importance in primary health care. In the present study, the goal was to evaluate the antianemic activity of fruit of Solanum melongena against phenylhydrazine-induced anemic rats.

MATERIAL AND METHODS

Plant profile

<table>
<thead>
<tr>
<th>Plant taken</th>
<th>Egg plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part used</td>
<td>Fruits</td>
</tr>
<tr>
<td>Kingdom</td>
<td>Plantae</td>
</tr>
<tr>
<td>Order</td>
<td>Solanales</td>
</tr>
<tr>
<td>Genus</td>
<td>Solanum</td>
</tr>
<tr>
<td>Species</td>
<td>S. melongena</td>
</tr>
</tbody>
</table>

Key words: Solanum melongena, Vitamin B₁₂, Anemia
Family: Solanaceae
Origin: South and East Asia

*S. melongena: Solanum melongena*

Preparation of extract

The fruits [Figure 1 and 2] were collected, shade dried and then converted into coarse powder. The powder was then filled in a Soxhlet apparatus for extraction by 70:30 hydroalcoholic as a solvent. The hydroalcoholic extract was concentrated by vacuum distillation to dry. The collected extract was stored in suitable container and used for further pharmacological studies.

Animals

Wistar strain male albino rats, weighing 100–150 g were selected for the study. The animals were housed individually in polypropylene cages under hygienic and standard environmental conditions (22 ± 3°C, humidity 30–70%, and 12 h light/dark cycle). The animals were allowed to have standard feed and water *ad libitum*. They were acclimated to the environment for 1 week before experimental use.

Antianemic activity[1-3]

Anemia was induced by intraperitoneal injection of phenylhydrazine at 60 mg/kg for 2 days, following the injections, rats were divided into five groups of six rats each.

- **Group I** - Control rats received 0.1% carboxymethyl cellulose.
- **Group II** - Phenyl hydrazine treated rats (60 mg/kg per day for 2 days).
- **Group III** - Phenyl hydrazine treated rats with Vitamin B₁₂ per day for 28 days.
- **Group IV** - Phenyl hydrazine treated rats with a single dose of fruit extract of *S. melongena* (100 mg/kg) per day for 28 days.
- **Group V** - Phenyl hydrazine treated rats with a single dose of fruit extract of *S. melongena* (200 mg/kg) per day for 28 days.

On the 29th day, the blood was collected in EDTA coated tube under by tail puncture under phenobarbitone (45 mg/kg, ip) anesthesia. The estimation of various biochemical parameters such as hemoglobin, RBC, and percentage hematocrit was evaluated.

**Statistical analysis**

Data were expressed as mean ± SEM. The data were analyzed using one-way analysis of variance followed by Dunnett’s *t*-test. *P < 0.05* was considered as significant.

<table>
<thead>
<tr>
<th>Drug treatment</th>
<th>RBC (10⁶ µL⁻¹)</th>
<th>Hb (g/dL)</th>
<th>HCT %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control (0.1% CMC)</td>
<td>8.81±0.65</td>
<td>13.72±0.65</td>
<td>48.78</td>
</tr>
<tr>
<td>Anemic control phenylhydrazine (60 mg/kg)</td>
<td>4.71±0.14</td>
<td>6.42±0.22</td>
<td>27.44</td>
</tr>
<tr>
<td>Reference control Vitamin B₁₂</td>
<td>8.44±0.42***</td>
<td>13.26±0.73***</td>
<td>47.29**</td>
</tr>
<tr>
<td>Test control - I <em>S. melongena</em> (100 mg/kg)</td>
<td>8.41±0.51***</td>
<td>13.27±0.70***</td>
<td>46.67**</td>
</tr>
<tr>
<td>Test control - II <em>S. melongena</em> (200 mg/kg)</td>
<td>8.53±0.34***</td>
<td>13.49±0.62***</td>
<td>49.92**</td>
</tr>
</tbody>
</table>

Data were expressed as mean±SEM (*n=6*). *P<0.05, **P<0.01 and ***P<0.001 versus anemic control. *S. melongena*: Solanum melongena, RBCs: Red blood cells.
RESULTS

Anti-anemic activity of Solanum melongena fruit extract on Phenylhydrazine induced hemolytic anemia in rats was studied and the results were shown on Table 1. The anti-anemic activity of Solanum melongena fruit extract was assessed by determining the red blood cell count, hemoglobin and hematocrit percentage. Phenylhydrazine decreased the RBC, Hb and % HCT as compared normal control. There was significant (P<0.001) increase in RBC and Hb with both Vitamin B12 and Solanum melongena fruit extract against phenylhydrazine challenge. Also there was significant (P<0.01) increase in % HCT with both Vitamin B12 and Solanum melongena fruit extract. This shows that Solanum melongena fruit effective anti-anemic activity against phenyhydrazine induced hemolytic anemia in rats and it has comparable effect as that of the standard drug Vitamin B12.

CONCLUSION

It has been concluded that the hydroalcoholic fruit extract of S. melongena exhibits antianemic activity against phenylhydrazine-induced anemia in rats. The antianemic effect produced by the S. melongena fruit may be due to its high content of iron which is present in the plant.

REFERENCES

INTRODUCTION

Alzheimer’s disease (AD) is a slowly progressive disease of the brain that is characterized by the impairment of memory and eventually by disturbances in reasoning, planning, language, and perception. Amyloid β-peptide (Aβ) is main source of oxidative stress in AD because it can acquire a free-radical state that contributes to its toxic effects. Aβ-induced cytotoxicity is caused by intracellular accumulation of reactive oxygen species, which leads to lipid peroxidation and cell death. Terminalia catappa Linn. is known for its nutritional value and having many medicinal benefits as well. T. catappa contain many medicinally essential phytoconstituents such as phenol, flavonoid, and carotenoid. Numerous pharmacological investigations have confirmed this plant’s ability to exhibit antimicrobial, anti-inflammatory, antidiabetic, hepatoprotective, and anticancer activities, all of which support its traditional uses.

MATERIALS AND METHODS

Preparation of plant extracts

Dried T. catappa subjected to hydroalcoholic extraction (70:30) by Soxhlet extraction.

Effect of Terminalia Catappa Extract on Biochemical Markers of Brain in Amnesic Rats

Joshi Ankur¹, Malviya Neelesh²

¹Department of Pharmacology, Modern Institute of Pharmaceutical Sciences, Research Scholar, Mandsaur University, Mandsaur, Indore, Madhya Pradesh, India, ²Department of Pharmacognosy, Smriti College of Pharmaceutical Education, Research Scholar, Mandsaur University, Mandsaur, Indore, Madhya Pradesh, India

Abstract

The present study was to evaluate the effect of Terminalia catappa extract on biochemical markers of brain in amnesic rats (scopolamine-induced amnesia). The extract of T. catappa extract was administered in two doses (100 and 200 mg/kg) for 7 days. Piracetam (120 mg/kg) was used as a standard nootropic agent. Brain biomarker such as superoxide dismutase, catalase, contents of thiobarbituric acid reactive substances, and reduced glutathione in whole-brain homogenates, and acetylcholinesterase (AChE) activity was determined. T. catappa extract administration reduced lipid peroxidation products and elevated glutathione. Short-term orally supplementation of T. catappa extract showed significant cognitive enhancement as well as elevated brain antioxidant enzymes and inhibited AChE activity.

Key words: Terminalia catappa, catalase, acetylcholinesterase superoxide dismutase, thiobarbituric acid reactive substances

INTRODUCTION

In vitro acetylcholinesterase inhibition assay

The assay for AChE activity was conducted using the method of Ellman et al.

Catalase assay (CAT)

CAT activities were Chance et al.

Superoxide dismutase assay (SOD)

SOD activity was estimated by the method of Kakar et al.

Reduced glutathione assay (GSH)

Reduced glutathione was estimated by the method of Jollow et al.

Estimation of a lipid peroxidation assay

The assay for lipid peroxidation was carried out as per Iqbal et al.

Address for correspondence:
Joshi Ankur, Modern Institute of Pharmaceutical Sciences, Research Scholar, Mandsaur University, Mandsaur, Indore, Madhya Pradesh, India.
E-mail: ankurpharmacology@gmail.com
RESULTS AND DISCUSSION

Data of the present study revealed that *T. catappa* significantly decreased brain AChE activity in rats [Table 2]. The activity of SOD is a sensitive index in oxidative damage as it scavenges the superoxide anion to form hydrogen peroxide leading to diminish the toxic effects. Data revealed that administration of both *T. catappa* (100 mg/kg) and *T. catappa* (200 mg/kg) increased the activity of SOD and CAT [Table 1]. Glutathione reductase is thought to be the fundamental antioxidant enzyme, for they are closely related to the direct elimination of reactive oxygen species. Supplementation of *T. catappa* (100 mg/kg) and *T. catappa* (200 mg/kg) for 7 days improved the activity, showing protection against free radicals. From these results, it was inferred that administration of *T. catappa* in healthy rat attenuated brain oxidative damages, increased activity of antioxidant enzymes, GSH, and AChE while decreased TBARS level [Table 1].

### REFERENCES


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**Table 1: Effect of orally *T. catappa* administration for 7 days in biochemical parameters of rat brain antioxidant status**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CAT</th>
<th>SOD</th>
<th>GSH</th>
<th>TBRAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle control</td>
<td>11.0±0.25</td>
<td>7.18±2.8</td>
<td>174.5±10.7</td>
<td>184.5±8.7</td>
</tr>
<tr>
<td>Scopolamine</td>
<td>9.0±0.21</td>
<td>5.02±3.2</td>
<td>156.0±12.3</td>
<td>160.56±7.6</td>
</tr>
<tr>
<td>Piracetam</td>
<td>16.0±0.39</td>
<td>20.23±1.8</td>
<td>230.0±17.23</td>
<td>218±5.9</td>
</tr>
<tr>
<td><em>T. catappa</em> (100 mg/kg)</td>
<td>15.5±2.8</td>
<td>13.5±1.4</td>
<td>203.3±15.3</td>
<td>200.3±7.3</td>
</tr>
<tr>
<td><em>T. catappa</em> (200 mg/kg)</td>
<td>14.0±1.12</td>
<td>18.3±1.7</td>
<td>218.0±13.5</td>
<td>208.0±11.0</td>
</tr>
</tbody>
</table>

*T. catappa*: *Terminalia catappa*, CAT: Catalase, SOD: Superoxide dismutase, GSH: Glutathione, TBRAS: Thiobarbituric acid reactive substances

**Table 2: Effect of the extract of *Terminalia catappa* on AChE inhibition activity**

<table>
<thead>
<tr>
<th>Treatments (mg/kg)</th>
<th>AChE concentrated (µMol/min/g of tissue)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle control</td>
<td>6.742±0.18</td>
</tr>
<tr>
<td>Scopolamine</td>
<td>10.39±0.35</td>
</tr>
<tr>
<td>Piracetam</td>
<td>5.683±0.28</td>
</tr>
<tr>
<td><em>T. catappa</em> (100 mg/kg)</td>
<td>4.907±0.31</td>
</tr>
<tr>
<td><em>T. catappa</em> (200 mg/kg)</td>
<td>4.967±0.31</td>
</tr>
</tbody>
</table>

*T. catappa*: *Terminalia catappa*, AChE: Acetylcholinesterase
**Comparative Study of Agomelatine and Venlafaxine for the Reduction of Buying Behavior in Obsessive Compulsive Disorder**

**Shaily Chaudhary¹, Nikunjana Patel², Indrajeet Singhvi³, Neelesh Malviya¹**

¹Department of Pharmacology, Smriti College of Pharmaceutical Education, MR-11, Dewas Naka, Indore, Madhya Pradesh, India, ²Department of Pharmacology, Faculty of Pharmacy, Shree S. K. Patel College of Pharmaceutical Education & Research, Ganpat University, Ganpat Vidy nagar, Gujarat, India, ³Department of Pharmacology, Pacific Academy of Higher Education and Research, Pacific University, Pratap Nagar Extension, Airport Road, Udaipur, Rajasthan, India

**Abstract**

Agomelatine, a novel melatonin agonist and selective serotonin antagonist antidepressant approved for major depressive disorder, has recently been additionally proposed as a treatment for anxiety disorders such as social anxiety disorder and panic disorder (PD). In addition, to rule out the role of enhanced serotonergic neurotransmission, studies were carried out in p-chlorophenylamine (PCPA). Results indicated a potent and dose-dependent influence of agomelatine on MBB of mice, which were maintained after its chronic administration. Treatment with PCPA was not able to inhibit the effect of agomelatine on marble-burying behavior. Further, the Dunnett’s multiple comparison test revealed that venlafaxine had a significant effect at 10 mg/Kg. In conclusion, agomelatine and venlafaxine administration reduces the MBB in mice, which should be explored for its potential use in the treatment of OCD.

**Key words:** Agomelatine, melatonin agonist, antidepressant

**INTRODUCTION**

Obsessive-compulsive disorder is an anxiety disorder characterized by intrusive thoughts that produce uneasiness, apprehension, fear or worry, repetitive behaviors aimed at reducing the associated anxiety, or a combination of such obsessions and compulsions.¹,²

**MATERIALS AND METHODS**

Adult male albino Swiss mice (22–25 g) were used for the present study. Agomelatine and DL-4-chloro-phenylalanine (PCPA, a selective serotonin depletor) were purchased from Sigma-Aldrich; venlafaxine was gifted by Sun Pharmaceuticals, Baroda, India. Agomelatine was dissolved in 1% hydroxyl ethyl cellulose while venlafaxine was dissolved in 0.9% saline solution and pcpa was dissolved in propylene glycol.

**Apparatus Marble-burying behavior test apparatus**

It consisted of plastic cages (40 × 28 × 14 cm) containing 5 cm thick wood dust bedding. 20 small glass marbles (~10 mm) were arranged on the bedding evenly spaced in four rows of five each.

**EXPERIMENTAL METHODS**

Assessment of marble-burying behavior and motor activity in mice

The marble-burying behavior and locomotor of mice were recorded as reported by Umathe et al., earlier with slight modifications (Umathe et al., 2008, Nicolas et al., 2006). In brief, mice were individually placed in marble-burying behavior apparatus with 20 glass marbles for 30 min.

**Address for correspondence:**
Shaily Chaudhary, Smriti College of Pharmaceutical Education (SCOPE), MR-11, Dewas Naka, Indore, Madhya Pradesh, India. E-mail: shaily.chaudhary@scopeindore.info
Treatments

**Experiment 1: Acute study**

Mice were randomly assigned to treatment conditions \( n = 6/12 \) in which agomelatine (10, 20, 30, 40, and 50 mg/kg, i.p.) and venlafaxine (0, 5, and 10 mg/kg, i.p.) were administered.

**Experiment 2: Combined drug study**

Mice were randomly assigned to treatment conditions \( n = 6/12 \) in which:

1. Pre-treated with PCPA (300 mg/kg, i.p.) for 3 consecutive days and 24 h thereafter 0.9% saline (10 mL/kg, i.p.) was administered 30 min before testing.
2. Pre-treated with PCPA (300 mg/kg, i.p.) for 3 consecutive days, and 24 h thereafter agomelatine (20 and 30 mg/kg, i.p.) was administered 30 min before testing.
3. Pre-treated with PCPA (300 mg/kg, i.p.) for 3 consecutive days, and 24 h thereafter fluoxetine (10 mg/kg, i.p.) was administered 30 min before testing.

**Influence of acute drug treatment on MBB and locomotor count**

**Agomelatine**

One-way ANOVA revealed that acute administration of agomelatine in different doses had a significant effect on the MBB of male mice \( F [5,53] = 6.835, P < 0.0001 \).

**Venlafaxine**

One-way ANOVA revealed that acute administration of venlafaxine in different doses had a significant effect on the MBB of male mice \( F [2, 17] = 5.729, P = 0.0412 \) [Figures 1-3].

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**Figure 1:** Influence of agomelatine on anticompulsive activity

**Figure 2:** Influence of venlafaxine on marble buried

**Figure 3:** Influence of venlafaxine on locomotor count
Combined studies

Influence of pCPA pre-treatment on the anticompulsive effect

Separate groups of mice were injected with pCPA (300 mg/kg, i.p., ×3 days) or vehicle (10 mL/kg, i.p., × 3 days), and 24 h after the past dose, vehicle (10 mL/kg, i.p.), agomelatine (20 mg/kg, i.p.), or venlafaxine (10 mg/kg, i.p.) were administered [Figure 4].

CONCLUSION

In the present work, agomelatine a novel melatonergic analog dose-dependent attenuated marble-burying behavior in mice, an effect that was comparable with that of venlafaxine. Pretreatment with pCPA, which blocked the effects of venlafaxine, failed to reverse the influence of agomelatine on marble-burying behaviour in obsessive–compulsive disorder. The anxiolytic actions of agomelatine are well documented; hence, the observed effect of agomelatine on marble-burying observed in the present study indicates its anticompulsive potential and prompts further evaluation in other animal models of compulsivity.

REFERENCES

**PCOG-01**

*In vitro Production of Withanolides from Hairy Root Cultures of *Withania somnifera* in Low-cost Protocol*

**Ajay G. Namdeo, K. R. Mahadik**

*Poona College of Pharmacy, Bharati Vidyapeeth Deemed University, Pune, Maharashtra, India*

**Address for correspondence:** Ajay G. Namdeo, Poona College of Pharmacy, Bharati Vidyapeeth Deemed University, Pune, Maharashtra, India. E-mail: agnamdeo@gmail.com

The objective of this study is to develop a low cost protocol for withanolide production from hairy root cultures of *Withania somnifera*. Explants of *W. somnifera* were transformed by infecting leaf explants with two wild type stains of *Agrobacterium rhizogenes* ATCC 15834 and MTCC 4364 and cultivated in media prepared in tap water supplemented with market sugar. The bacterial cultures were subculture in yeast extract broth medium. The neoplastic roots produced by *A. rhizogenes* were characterized by high growth rate and genetic stability. Transgenic nature of hairy roots was confirmed by opine determination using paper electrophoresis. Seven transformed clones of hairy roots were established and grown in liquid and solid medium for the analysis of secondary metabolite. Morphological marker, i.e., appearance of hairy roots at wounded sites on explants and biochemical marker, i.e., paper electrophoresis for opine detection confirmed the transformation. High-performance layer chromatography and high-performance thin-layer chromatography of genetically modified hairy roots of *W. somnifera* revealed enhanced production of bioactive compounds withanolides. Low-cost protocol using market sugar and tap water is developed for the production of withanolides from hairy root cultures of *W. somnifera*. Sucrose contributes to about 95% of total cost of tissue culture medium. Apart from sucrose, cost of double distilled water contributes maximum to the cost of the medium. In the present investigation, experiments were performed in medium prepared in tap water and market sugar as carbon source.

**PCOG-02**

*Formulation and Evaluation of Herbal Tablet for the Treatment of Digestive Disorders*

**Sumeet Dwivedi, Satyaendra Shrivastava, P. K. Dubey**

*Department of Pharmacognosy, Swami Vivekanand College of Pharmacy, Indore, Madhya Pradesh, India*

**Address for correspondence:** Sumeet Dwivedi, Department of Pharmacognosy, Swami Vivekanand College of Pharmacy, Indore, Madhya Pradesh, India. E-mail: herbal0914@rediffmail.com

Digestive disorders (heartburn/GERD, IBD, and IBS) are very common nowadays due to lifestyle and social habits of human beings. The symptoms may include bloating, diarrhea, gas, stomach pain, and stomach cramps. There are various allopathic medicines available to treat the same, but the relief is temporary and has several side effects. Herbal drugs play an important role in the treatment of digestive disorders due to safety and efficacy. Therefore, the present work was conceived to formulate an effective herbal tablet used for the treatment of the same. Seven batches (F1, F2, F3, F4, F5, F6, and F7) of herbal tablet were prepared using different compositions of herb, namely Myrobalan, Amla, Ajwain, and Cumin. The formulated herbal tablet was evaluated. The results show that the formulation code; F5 have maximum drug content and drug release. Furthermore, attempt was made to determine the microbial load of formulation (F5). The efficiency of herbal tablet for digestive property was further confirmed by finding the amylolytic activity and was compared with a marketed formulation.
Development of Polyherbal with Antioxidant Activity

Jain Deepak¹², Jain Anurekha³

¹Pacific Academy of Higher Education and Research University, Udaipur, Rajasthan, India-313024, ²B.R. Nahata College of Pharmacy, MU University, Mandsaur, M.P., India-458001, ³Dean, Jayoti Vidyapeeth Women’s University, Jaipur, Rajasthan, India-303122

Address for correspondence: Jain Deepak, Pacific Academy of Higher Education, B.R. Nahata College of Pharmacy, MU University, Mandsaur, Madhya Pradesh, India. E-mail: deepak_nisha99@rediffmail.com

Ayurvedic system of medicine is as old as human civilization. The present study involves the development of a polyherbal formulation using four different herbs, i.e., fruits of Momordica charantia Linn., bark of Eugenia jambolana Linn., fruits of Ziziphus mauritiana Lam., and bark of Acacia catechu Willd. The collected and authenticated herbs were characterized by studying its morphological and pharmacognostic character. Phytochemical screening showed the presence of alkaloids, glycosides, carbohydrates, amino acid, tannin, steroids, and flavonoids in the combination extract. Physical parameters such as solubility, pH, ash values, LOD, and extractive value have been studied. The antioxidant activity of the combination of extract (100 mg each) was determined using 2,2-diphenyl-1-picrylhydrazyl free radical scavenging method. The results showed that the combination extract has best antioxidant effect at a dose of 400 µg/mL when it was compared with ascorbic acid as reference standard.

Herbal Dental Gel of Essential Oils for Treatment of Periodontal Diseases

Reena Soni, Divya Rane, Praful Soni

Department of Pharmacy, Shri G.S. Institute of Technology & Science, Indore, Madhya Pradesh, India

Address for correspondence: Reena Soni, Department of Pharmacy, Shri G.S. Institute of Technology & Science, Indore, Madhya Pradesh, India. E-mail: reenasoni019@gmail.com

Dental ailments are frequently encountered health problems in human being throughout the world. There are various dental diseases such as pyorrhea, dental caries, and oral candidiasis which generally occur due to improper cleaning of teeth. Natural remedies are more acceptable in the belief that they are safer with fewer side effects than synthetic ones. Herbal drugs cannot be directly used as in its crude form, rather needs to be formulated in a specific dosage form, for example, tooth powder, mouthwash, and gel. The present research work aims to formulate and evaluate the herbal dental gel containing clove oil and eucalyptus oil having bactericidal activity in mouth, reducing plaque, and preventing gum diseases. The herbal dental gel was formulated using Carbopol 934 and gum tragacanth as gelling agents, NaOH as neutralizing agent, menthol, and camphor as analgesic, and counterirritant. The formulated dental gel was evaluated for physical and antimicrobial activity. The appearance was found to be transparent, homogeneous with good spreadability, and no grittiness. In antimicrobial test, number of microbial colonies observed in Plate-A (Blank), Plate-B (Test), and Plate-C (Reference) was 9, 5, and 4, respectively, which confirms that the antimicrobial activity of developed formulation is comparable to marketed product. Thus, has a good scope in future in natural remedies for dental health of public.
PCOG-24

Evaluation of Antidiabetic Activity of Root and Stem Extract of *Quisqualis indica* Linn

Yashraj Yadav, Ragvaendra Dubey, Sourabh Jain, Nitesh Jain

*School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India, Pinnacle Biomedical Research Institute, Bhopal, Madhya Pradesh, India, ¹Dr. A.P.J Abdul Kalam University, Indore, Madhya Pradesh, India, ²Oriental University Indore, Indore, Madhya Pradesh, India*

**Address for correspondence:** Yashraj Yadav, Pinnacle Biomedical Research Institute, Bhopal, Madhya Pradesh, India.
E-mail: yashrajyadav@gmail.com

Diabetes is a chronic disease, which occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces. Indian system of medicine uses around 2,500 plant species of about 800 species are used by industry and approximately 25% species are cultivated. As per the WHO estimate, about 80% of the population of developing countries relies on traditional medicine, mostly plant-based drugs for their primary health care. The *Q. indica* Linn. plant is widely used either directly as folk the review by considering the traditional background and several research articles on *Q. indica* Linn., belongs to family Combretaceae; alloxan-induced antibiotic activity performed in root and stem extract of *Q. indica* after extraction process and phytochemical investigation. Wister rat used animal model after performed toxicity studies animal was treated as dose 250 and 500 mg EEQIR and EEQIS. both EEQIR and EEQIR show antidiabetic activity, but root extract is show more antidiabetic property rather than stem; hence, present investigation established some pharmacological evidences to support the folklore claim that quisqualis indica is use as antidiabetic agent.

PCOG-25

Development of Quality Control Parameters for Balchaturbhadra Churna

Nazim, Uzma Bano, Shahbaz Khan, Kanika Dhote, Vinod Dhote, H. S. Chandel

*School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India, Truba Institute of Pharmacy, Bhopal, Madhya Pradesh, India*

**Address for correspondence:** Nazim, Truba Institute of Pharmacy, Bhopal, Madhya Pradesh, India.

The increasing demands for traditionally used herbal products worldwide have prompted to offer new ways of assessing quality, efficacy, and safety. Churna is powdered preparations of drugs used for oral administration. They may be of two type’s simple churna and compound churna. Balchaturbhadra churna is a well known Ayurvedic formulation described in Ayurvedic Formulary of India. It is an effective and well-tolerated treatment option in the management of diarrhea and emesis. This contains equal quantity of *Piper longum* (Pippali), *Pistacia intergerrima* (Shrngi), and *Aconitum heterophyllum* (Atis), and *Cyperus rotundus* (Nagarmotha), its prescribed dose is of 0.5–1 g. A comparative study was performed between laboratory and marketed churnas. Laboratory churna was prepared as per the method given in Ayurvedic Formulary of India and the marketed churna was purchased from the local market and was standardized according to guidelines of the World Health Organization for macroscopic characters, moisture content, extractive value, ash value, phytochemical screening, micromeritic parameter, thin-layer chromatography, foreign matter, and pH. Tannic acid estimation was performed by ultraviolet spectroscopy. The results of studies performed on the churnas were found to be precise, reproducible and can be considered for routine quality control of the churna.
PCOG-26

Assessment of Antiulcer Activity of Alcoholic Extracts of Gloriosa superba Tubers

S. Suryavanshi, O. P. Choubitkar, P. Sharma, S. P. Pandey, H. S. Chandel

Department of Pharmaceutical Chemistry, Truba Institute of Pharmacy, Bhopal, Madhya Pradesh, India

Objective: The objective of the study was to evaluate the antiulcer activity of alcoholic extracts of Gloriosa superba tubers.

Methods: Extracts from hot continuous extraction method and cold maceration extraction method were studied against pylorus ligation-induced ulcers in rats, ethanol-induced ulcers in rats, and indomethacin-induced ulcers in rats at 200 and 400 mg/kg. Result: A significant ($P < 0.001$ and $P < 0.01$) antiulcer activity was observed in all models. Pylorus ligation, ethanol induced, and indomethacin-induced ulcer models showed significant ($P < 0.001$ and $P < 0.01$) reduction in pH, gastric volume, free acidity, and total acidity, and ulcer index is compared to control. It also showed percentage protection 44.39%, 55.80%, 39.95%, and 48.08% in pylorus ligation, 34.1%, 51.72%, 35.1%, and 46.8% in ethanol-induced ulcers, and 44%, 56.3%, 35.2%, and 50.3% in indomethacin-induced ulcers. Conclusion: Investigation of the antiulcer activity of alcoholic extracts of G. superba tubers was performed. The significant antiulcer activity might be attributed due to the phytoconstituents present in it.

PCOG-27

Antimicrobial Activity of Hydroalcoholic Extract of Moringa oleifera

Lawana Arun, Khan Sazeed, Gour Ravi

Truba Institute of Pharmacy, Bhopal, Madhya Pradesh, India

Moringa oleifera is the most widely cultivated species of the genus moringa which from the family of Moringaceae. It is fastest growing drought resistance tree it can used for water purification. Moringa seeds contain dimeric cationic proteins which absorb and neutralize colloidal charges in turbid water causing the colloidal particles to clump together making the suspended particles to remove as sludge by either settling or filtration moringa seeds cake removes most impurities from water. Anything that destroy bacteria or suppress their growth or their ability to reproduce heat chemicals such as chlorine and antibiotics drugs all have antimicrobial property. Antimicrobial activity of moringa oleifera has been done by agar disc diffusion method this method based on principle that antibiotic-impregnated disc placed on agar previously inoculated with the test bacterium pick up moisture. The clear zone or ring is formed around an antibiotic disc after incubation. That shows the agent inhibit the microbial growth.
Formulation and Development of Antifungal Liquid Vaporizer for Coastal Area: A Social Innovative Idea for Society

Vivekanand Kisan Chatap

H. R. Patel Institute of Pharmaceutical Education & Research, Karwand Naka, Shirpur, Dhule, Maharashtra, India

Address for correspondence: Vivekanand Kisan Chatap, H. R. Patel Institute of Pharmaceutical Education & Research, Karwand Naka, Shirpur, Dhule, Maharashtra, India. E-mail: chatap@rediffmail.com

The novelty of the proposed research lies in the fact that liquid vaporizer has gained lot of attention in the recent time for its use as mosquito repellent. Although research is going on worldwide in wrong direction for the treatment fungal infections, current need is to do the research for prevention of fungal infections. The amount of research done in India is extremely less and not found satisfactory results. In the proposed research, we are utilizing the herbal essential volatile oils, which acts as potent antifungal, antimicrobial, stabilizer, bad odor masking, mood elevator, and air refresher for inhibition or killing of fungal growth not only in coastal area but also all over the place where high humid environment is presents.

Formulation and Evaluation of Paracetamol Contain Antipyretic Chocolate

Ankit Mangal, Neelesh Malviya, Supriya Biswas

Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

Address for correspondence: Ankit Mangal, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India. E-mail: ankitmangal75@gmail.com

The objective of the present study is to develop a chocolate formulation of paracetamol for relief in fever with improved patient compliance and also compatible to pediatric patients. The formulation consists of developing a chocolate base containing a cocoa powder, cocoa butter, milk powder, and pharmaceutical grade sugar. Subsequently drug is incorporated to aforesaid prepared chocolate base. The prepared medicated chocolate was evaluated for appearance, moisture content, in vitro drug release, blooming test, and drug content. In vitro dissolution studies of formulated chocolate were performed in USP dissolution apparatus Type 1 (Basket), using 0.1N HCl as a dissolution media. Prepared formulation showed complete release of paracetamol with 98.59% at the end of 90 min. The drug release from the chocolate shows first-order release kinetics and diffusion mechanism.
Development and Evaluation of HP-β-CD Complexation-Based Novel Ophthalmic in situ Gel Formulation of Nepafenac

Prerna Chouhan, Prakash K. Soni, Abhishek Chouhan
Shri G. S. Institute of Technology & Science, Indore, Madhya Pradesh, India

Address for correspondence: Prakash K. Soni, Shri G. S. Institute of Technology & Science, Indore, Madhya Pradesh, India. E-mail: soniprakashpharma@gmail.com

Nepafenac, an NSAID used as analgesic anti-inflammatory in post-operative ocular pain is presently available in the market in the form of 0.1% ophthalmic suspension eye drop due to aqueous insolubility of the drug. The present formulation is not only poor patient compliant due to suspension form but also suffers from short corneal residence and inadequate ocular bioavailability. The objective of the present research work is to enhance the aqueous solubility of lipophilic drug nepafenac and develop its ocular in situ gel formulation for overcoming the drawbacks of presently available product. The 10% w/v HP-β-CD solution was used to formulate nepafenac in solution form, which resulted in 57.14-fold solubility enhancement of nepafenac in water, facilitating the development of nepafenac eye drop in solution form. To enhance the pre-corneal residence of the formulation, the drug solution was incorporated into a hydrogel base, i.e., Gellan gum capable of ion-activated sol-to-gel transformation in ocular environment. The developed in situ gel formulation was evaluated for their physical appearance, drug content, pH, osmolality, in vitro gelation property, in vitro drug release, and ex vivo transcorneal drug permeation, and all studied parameters were found satisfactory and acceptable. Transcorneal drug permeation study revealed that there was approximately 1.38 times enhancement in the drug permeation flux during 24 h study for developed in situ gel as compared to marketed product. In situ gel had satisfactory results for all the evaluating parameters which showed that the HP-β-CD complexation-based novel ophthalmic hydrogel formulations were successfully developed and may be a better alternative to the presently available 0.1% suspension eye drops.

Formulation and Evaluation of Solid Self-emulsifying Drug Delivery System of Atorvastatin

Porwal Ayush, Shrivastava Vivek, Jain Ankur, R. K. Nema
Lakshmi Narain College of Pharmacy (RCP), Indore, Madhya Pradesh, India

Address for correspondence: Porwal Ayush, Lakshmi Narain College of Pharmacy (RCP), Indore, Madhya Pradesh, India. E-mail: ayushporwal225@gmail.com

The present work aims to develop and characterize atorvastatin-loaded solid self-emulsifying drug delivery system for effective management of hypolipidemia for improving bioavailability, to enhance solubility, to prolong residence time, and to provide sufficient amount of drug to target site in a sustained manner. Atorvastatin is a BCS Class II (low solubility and high permeability) compound. Atorvastatin is rapidly absorbed in upper gastrointestinal tract. Its oral bioavailability is about 14%; this low bioavailability might be due to poor dissolution, presystemic clearance in the gut wall, and first pass effect. SEDDS formulation of atorvastatin are developed using different oils, surfactant and cosurfactant combinations. The microemulsifying region is found using pseudoternary phase diagram. Formulations based on this microemulsion region are prepared using various oils, surfactants, and cosurfactants. The basic evaluation parameters for liquid SEDDS are clarity, droplet size, emulsification time, percentage transmittance measurement, and in vitro dissolution study. Solidification of liquid SEDDS will be done by adsorbing the liquid SEDDS on various solid adsorbents aerosil 200, aerosil 300, etc. The in vitro dissolution of solid SEDDS will be compared to marketed atorvastatin formulation.
L-valin Conjugated PLGA Nanoparticles for Oral Insulin Delivery

Sanjay Mishra, M. K. Gupta, Khushbu Jain, N. K. Jain, Gurdeep Singh

Oriental College of Pharmacy & Research, Oriental University, Indore, Madhya Pradesh, India

Address for correspondence: Sanjay Mishra, Oriental College of Pharmacy & Research, Oriental University, Indore, Madhya Pradesh, India. E-mail: mishra_sanjay87@rediffmail.com

Oral delivery is the preferred route of administration because it offers several advantages over other routes. However, it is not an effective route for the delivery of peptides and proteins because of so many constraints. The small intestine has been shown to be able to transport the L-forms of amino acids against a concentration gradient and that they compete for the mechanism concerned. Hence, L-valine was used as a ligand for carrier-mediated transport of insulin-loaded PLGA nanoparticles. L-valine-conjugated PLGA-nanoparticles were prepared using double emulsion solvent evaporation method. The insulin bearing nanoparticles were also studied for size, drug entrapment efficiency, zeta potential, and polydispersity index, and \textit{in vitro} insulin release. \textit{Ex vivo} studies on intestine revealed that conjugated nanoparticles showed greater insulin uptake as compared to nonconjugated nanoparticles. In \textit{vivo} studies were performed on streptozotocin-induced diabetic rabbits. Oral suspension of insulin-loaded PLGA nanoparticles reduced blood glucose level from 265.4 ± 8.5 to 246.6 ± 2.4 mg/dL within 4 h which further decreased to 198.7 ± 7.1 mg/dL value after 8 h, the ligand conjugated formulation on oral administration produced hypoglycemic effect within 4 h of administration, the hypoglycemic effect prolonged till 12 h of oral administration. Simultaneously, the insulin concentration in withdrawn samples was also assessed and found that profile of insulin level is in compliance with the blood glucose reduction profile. Compared with formulation-loaded with the drug, the valine conjugated nanoparticles produced a sustained hypoglycemic response till 12 h than 8 h. Hence, it is concluded that the L-valine conjugated NPs bearing insulin are the promising carrier for the transportation of insulin across the intestine on oral administration.

Theranostics: Amalgamation of Therapeutics and Diagnostics

Kalvatala Sudhakar\textsuperscript{1}, R. Narayana Charyulu\textsuperscript{2}

\textsuperscript{1}School of Pharmaceutical Sciences, Lovely Professional University, Jalandhar, Punjab, India, \textsuperscript{2}NGSMIPS, Nitte University, Mangalore, Karnataka, India

Address for correspondence: Kalvatala Sudhakar, School of Pharmaceutical Sciences, Lovely Professional University, Jalandhar, Punjab, India. E-mail: ckbhaipharma@gmail.com

Theranostics is concept of unification of therapeutics and diagnostics, which is an array for image-guided therapy. Through theranostics, formulation scientist can gain data about the movement pathway, rate and extent of drug delivery and efficiency. The concept is to deliver the drug therapy and then examining the effect. Theranostics floors the alleyway for personalized medicine. State-of-the-art of theranostics is depends on the material used in theranostics formulation such as dendrimers, quantum dots, carbon nanotubes, magnetic nanoparticles, liposome, gold nanoparticles, and silica nanoparticles are some platform for the theranostics agent. Theranostics nanomaterials are multipurpose nanosystems, which are well fabricated for more precise and tailored disease management by mingling diagnostic and therapeutic competencies into one single biocompatible and biodegradable nanocarrier. The fabrication of theranostics nanocarrier seems to be shown more advantage than simple nanocarrier. Assimilation of therapeutic molecule with diagnostic agents into theranostics nanocarrier would be highly beneficial as rate and extent of drug and efficiency can be determined.
PCS-27

Therapeutic-loaded Microemulsion-based Transdermal Formulation for Management of Spasm

T. Shukla, S. P. Pandey², N. Upmanyu¹

¹School of Pharmacy and Research, Peoples University, Bhopal, Madhya Pradesh, India, ²Truba Institute of Pharmacy, Bhopal, Madhya Pradesh, India

Address for correspondence: T. Shukla, School of Pharmacy and Research, Peoples University, Bhopal, Madhya Pradesh, India.

Thiocolchicoside is competitive GABAA receptor antagonist and also glycine receptor antagonist acting as anti-inflammatory and muscle relaxant. Considering the side effects and lower bioavailability of thiocolchicoside (25%) with half-life of 5–6 h, an attempt has been made for the formulation development of microemulsion for its transdermal application using peppermint oil as oil phase whereas tween 80 and 1-butanol as surfactant and cosurfactant. On the basis of ternary plot 1:1 ratio (surfactant and cosurfactant) was selected for the development of drug-loaded microemulsion formulation. In vitro characterization of optimized formulation such as zeta size, zeta potential, conductivity, refractive index, and viscosity was performed to evaluate the prepared formulation. Results show the higher stability and optimum drug loading. In vitro drug release of the optimum formulation (Microemulsion-loaded gel) exhibited a drug release of 37.4% at the end of 4 h. Flux as well as permeability coefficient was calculated, and the value was found to be 104.53 ± 5.7 and 0.048, respectively, showing the optimum drug permeation through skin at higher rate. In the present study, it can be concluded that the microemulsion of thiocolchicoside could be developed for the better penetration and enhanced bioavailability but still an exhaustive study is needed in this regard for developing a better and cost-effective formulation of thiocolchicoside.

PCS-28

Effect of Herbomineral Preparation and their Corresponding Metal Nanoparticle on Enzymatic Activity and Growth Pattern of Bakers Yeast

S. P. Pandey¹, M. S. Sudheesh²

¹TRUBA Institute of Pharmacy, Bhopal, Madhya Pradesh, India, ²VNS Institute of Pharmacy, Bhopal, Madhya Pradesh, India

Address for correspondence: S. P. Pandey, TRUBA Institute of Pharmacy, Bhopal, Madhya Pradesh, India.

Metals are the integral part of human life and being used as aid in some ayurvedic herbomineral preparation (Bhasma) system since more than 5000 years and these ayurvedic preparations are generally thought to be safe in comparison of modern medicines, as these are derived mainly from natural sources such as natural resources, herbs, and plant extracts. However, the use of such metals has always been the matter of debate as the modern system has proved that irrational and longer use of even safer metal have created so many of the problems. The basic aim of this research was to find out the ill effect of such metallic preparation (Mandur bhasma) used in Ayurvedic medicine system and their corresponding iron nanoparticles using Baker’s yeast (S. cerevisiae) and biological enzymes. For the study, initially culture Baker’s yeast was prepared in the pre-sterilized YPD media. Growth and morphological change in baker’s yeast cell were studied in presence of the marketed Ayurvedic formulation and its corresponding metal nanoparticles. At the similar time, standard microbiological assay procedures were also performed to find out the impact of these preparations on growth and morphology of yeast cells. An enzyme blocking study using the enzymes was also performed. Results shown that the iron nanoparticles (in higher concentration) have inhibitory effect on the growth of yeast cells in comparison to the respective formulation. At the same time, the yeast cells show aggregation behavior and damaging with abnormal surface in case of metallic nanoparticles. Effect on enzymatic activity was also found significant. On the basis of the present study, it could be concluded that metals present in the ayurvedic preparations in sodhit form do not have any objectionable behavior but there is certain need of pharmacovigilance to follow standard protocol to establish the safety and efficacy of such ayurvedic preparations and before coming to any final conclusion, still number of studies will also be needed.
PCHEM-02

2D and 3D Qsar Analysis of Azine Derivatives as Antidiabetic Agents

Jitendra Sainy, Rajesh Sharma

School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Campus, Indore, Madhya Pradesh, India

Address for correspondence: Jitendra Sainy, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Campus, Indore, Madhya Pradesh, India.

In this study, a series of azine derivatives was selected for its hologram quantitative structure-activity relationship (HQSAR), comparative molecular field analysis (CoMFA), and comparative molecular similarity indices analysis (CoMSIA) analysis as antidiabetic agents. The LOO cross-validated $q^2$ values of HQSAR, CoMFA, and CoMSIA models were found to be 0.802, 0.882, and 0.813, respectively. The predictive capability of the generated models was endorsed further by a test set of 14 compounds. The predicted pIC$_{50}$ values were in good harmony with the experimentally detected pIC$_{50}$ values. The best HQSAR model was generated using atoms, bonds, connection, hydrogen atoms, donor, and acceptor as fragment distinction parameter with fragment size (6–9) using a hologram length of 437 and 6 components. The fragment contribution map of HQSAR represented that the presence of hydrophobic group such as long alkyl chain at R$_1$ position and presence of hydrogen bond acceptor group at R$_2$ position is favorable for antidiabetic activity. The results of 3D QSAR are in good agreement with 2D QSAR results.

PCHEM-03

Comparative Study Between Para-chloro and Para-fluoro Novel Pyrazole Derived Samples with the Help of their Physiochemical and Structural Evaluation

Anjali Chandani, Sonali Sharm$^a$, Rishabh Saxen$^a$

VNS Faculty of Pharmacy, VNS Group of Institutes, Neelbad, Bhopal, Madhya Pradesh, India

Address for correspondence: Anjali Chandani, E-mail: chandanianjali1asv@gmail.com

There are many pyrazole compounds with various types of activities available in the market. Many of the recent studies focusing on the biological activities of pyrazole derivatives say that the pyrazole derivative having para-chloro ring has much more analgesic activity in comparison to the pyrazole derivative with para-fluoro ring. As per the structure–activity relationship, the two structures when compared have a difference in the electronegative group attached to their third ring. The structure 1 (SS-1) here, i.e., 1{1-(4-chlorophenyl-prop-2-ene-1-one)-3-(3,4-dimethoxyphenyl)-5-(4-chlorophenyl)}4,5 dihydro-1H-pyrazole-3-yl has chloride ion as the electronegative group attached to the 4$^\text{th}$ position on the its third ring, whereas structure-2 (SS-2) here, i.e., 1{1(4-fluorophenyl-prop-2-ene-1-one)-3-(3,4-dimethoxyl)-5-(4-chlorophenyl)}4,5 dihydro-1H-pyrazole-3-yl has one fluoride ion as the electronegative group attached to its para position on its third ring. The research paper here focuses on the comparative studies of the two sample structures with the help of physiochemical as well as structural evaluation.
Validation of a Liquid Chromatographic Method for the Determination of Pantoprazole Sodium Residues on Surfaces in the Manufacture of Pharmaceuticals

Ram Singh Bishnoi¹, Neha Vishnoi², C. P. Jain¹

¹Department of Pharmaceutical Sciences, Mohanlal Sukhadia University, Udaipur, Rajasthan, India, ²Department of Microbiology, Peoples Dental Academy, People’s University, Bhopal, Madhya Pradesh, India

Address for correspondence: Ram Singh Bishnoi, Department of Pharmaceutical Sciences, Mohanlal Sukhadia University, Udaipur, Rajasthan, India. E-mail: bishnoiram@gmail.com

A liquid chromatographic method for determination of the residues of pantoprazole sodium on various surfaces employed in drug manufacture is described. Cotton swabs, moistened with a methanol–water (1:1 v/v) mixture were used to remove any residues of drugs from Teflon plates and stainless steel surfaces, and gave recoveries of 93.65%, and 89.92%, respectively. Residues were determined by high-performance liquid chromatography on a C₁₈ column at 25°C with methanol–formic acid (0.15% pH 3.0) in the ratio of 80:20 at flow rate 1.0 mL/min and detection at 292 nm. The method was validated over a concentration range of 2.5–50 ug/mL and had a detection limit of 100 ng/mL.

Molecular Docking of Some Schiff Base Derivative as Antimicrobial Agent

Shreya Nigam, Love Kumar Soni

Department of Pharmacy, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India

Address for correspondence: Shreya Nigam, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India. E-mail: 94shreyanigam@gmail.com

In present work, we have done molecular docking on antimicrobial agent. In which, we have designed schiff base derivative as antimicrobial agent. We have designed eight compounds and done molecular docking using PDB ID 3U2D which acts as an antibacterial agent and PDB ID 1AOE which acts as antifungal agent. The dock eight compounds give's best dock score and alignment.
PCHEM-06

Qsar Studies on 3-(4-Chloro-2-Hydroxyphenyl)-2-(Substituted) Thiazolidin-4-One as Antibacterial Agents

Srijal Patel, Love Kumar Soni

School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Campus, Indore, Madhya Pradesh, India

Address for correspondence: Srijal Patel, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Campus, Indore, Madhya Pradesh, India. E-mail: patelsrijalpatel@gmail.com

Termination of cell wall synthesis by inhibiting biosynthesis of peptidoglycan can be fruitful way to design a powerful lead against bacterial infections. An active scaffold of thiazolidin-4-one was found to have efficient inhibitory activity against UDP-N-acetylmuramoylalanine—D-glutamate ligase (MurD ligase). In this series of work, here we report quantitative structure–activity relationship QSAR analysis performed by Hansch analysis and Fujita-Ban using VALSTAT, on a series of 3-(4-chloro-2-hydroxyphenyl)-2-(substituted) thiazolidin-4-one. Interpretation of generated QSAR models reveal that a nitrogen heterocyclic ring with a bulky substitution on 2nd and 4th position having hydrogen bond donor nature will increase the antimicrobial activity.

PCHEM-08

Synthesis of Highly Substituted Indenes from Aryl Vinyl Alcohol

Pawan Goud¹, Shivendra S. Raghuwanshi²

¹Modern Institute of Pharmaceutical Sciences, Indore, Madhya Pradesh, India, ²National Institute of Pharmaceutical Education and Research, Hyderabad, Telangana, India

Address for correspondence: Pawan Goud, Modern Institute of Pharmaceutical Sciences, Indore, Madhya Pradesh, India. E-mail: Pawangoud63@gmail.com

Cyclopentane motif is a privileged structure because of its widespread occurrence in many synthetic organic molecules and biologically active natural products such as prostaglandins, steroid, and terpenoid. The classical approach toward the construction of cyclopentenone rings is the nazarov cyclization, a cationic electrocyclization that converts divinyl ketones to cyclopentenones by activation with protic or Lewis acids. Electrocyclic reactions are a powerful synthetic transformation with the ability to create new carbon-carbon bonds stereospecifically by the simple orbital reorganization. Synthesis of tertiary hydroxyl containing aryl, vinyl, and methyl and their application in the synthesis of highly substituted indenes were described.
**PCHEM-11**

Two Dimensional Quantitative Structure–activity Relationship Study 2-Aminobenzothiazole Derivatives as Anticonvulsant Activity

Bhagat Singh Chouhan, Love Kumar Soni

*School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Parisar, Indore, Madhya Pradesh, India*

**Address for correspondence:** Bhagat Singh Chouhan, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Parisar, Indore, Madhya Pradesh, India. E-mail: chouhan.bhagatsingh7687@gmail.com

Two dimensional quantitative structure–activity relationship studies were carried out on a series of novel 6-substituted 2-aminobenzothiazole analogs to elucidate the structural properties required for anticonvulsant activity. The study was performed using multiple linear regression method giving $r^2 = 0.88$ and $q^2 = 0.63$ for Hansch analysis, $r^2 = 0.82$ and $q^2 = 0.68$ for Fujia-Ban analysis, respectively. Thus, this validated model provides an important structure insight for designing of novel anticonvulsant agents.

**PCHEM-18**

Molecular Docking of Potent Bruton’s Tyrosine Kinase Inhibitors

Shweta Mishra, Rashmi Dahima

*School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Parisar, Indore, Madhya Pradesh, India*

**Address for correspondence:** Shweta Mishra, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshashila Parisar, Indore, Madhya Pradesh, India. E-mail: shwetaMishraIndore@gmail.com

Bruton’s tyrosine kinases are critical enzymes that regulate the B cell development, growth and degeneration. In humans, Btk is responsible for autoimmune diseases, X-linked agammaglobulinemia, inflammation, several B-cell malignancies, protein signaling, and arthritis. However, at least 400 mutational changes in the Btk gene lead to death among young and middle-aged women. In this paper, preliminary *in silico* screening was performed using the piperazine moiety, imidazolyl substituted carboxylic acid moiety, and diphenyl pyrimidines that were thought to have potential to inhibit Btk. Of 89 derivatives, in comparison with standard drug Ibrutinib compound 72, 44, and 45 exhibited maximal interactions that were important for inhibition were screened for further designing of compounds that would be metabolically stable. It gives the deeper insight into structural attributes and overall molecular interactions. From this study, we propose that these compounds can be used for designing potent Btk inhibitors.
**PCHEM-23**

**Development and Validation of Stability Indicating Assay Method for Estimation of Gemigliptin and its Degradants by Reversed-phase Ultra Performance Liquid Chromatography**

Avnish Jain, Love K. Soni, Rajesh Sharma

*Department of Pharmacy, School of Pharmacy, DAVV, Indore, Madhya Pradesh, India*

This work aims to develop simple, accurate, precise, rapid, and economical stability indicating reversed-phase ultra performance liquid chromatography assay method for Gemigliptin which is used for the treatment of major metabolic disorder diabetes mellitus. In this method, estimation was performed using THERMO UHPLC with ultimate 3000 DAD detector fitted with Hypersil Gold C-18 column (150*4.6 mm, 3micron particle size). High resolution isocratic separation was achieved using mobile phase consisting of Acetonitrile:methanol:water (50:30:20) at a flow rate of 1.25 mL/min. Retention time was found to be 1.32 min with nearly 142650 N plates/meter column and tailing factor 1.05%. Gemigliptin showed excellent linearity ($r^2 > 999$) over 50–250 µg/mL concentrations. The force degradation of gemigliptin was carried out using acid hydrolysis, base hydrolysis, oxidative degradation, and thermal degradation. In all degradation conditions applied Gemigliptin was well separated from its degradants. Study showed that there is significant degradation under alkaline and oxidative conditions. This method was found to be simple, accurate, economical, robust, and reproducible. This developed method has been validated for linearity, accuracy, precision, limit of detection, limit of quantification, and system suitability according to the ICH guidelines.

**PCOL-04**

**Antibiotic Evaluation of Odontogenic Microbiological Spectrum of Orofacial Infection**

Neha Vishnoi¹, Sapna Singh¹, Ram Singh Bishnoi², Vinod Singh³, M K Gupta⁴

¹Department of Pharmacy, People’s Dental Academy, Bhanpur, Bhopal, Madhya Pradesh, India, ²Department of Pharmacy, Barkatullah University, Bhopal, Madhya Pradesh, India, ³Department of Pharmacy, Oral Maxillofacial Surgeon, Nagpur, Maharashtra, India, ⁴Department of Pharmaceutical Sciences, M.L.S. University, Udaipur, Rajasthan, India

**Address for correspondence:** Neha Vishnoi, People’s Dental Academy, Bhanpur, Bhopal, Madhya Pradesh, India E-mail: nh.vishnoi@gmail.com

The aim of this study was to investigate the microbial flora and simultaneously evaluate its antibiotic response in patients associated with odontogenic infection. Samples for the analysis were taken from the Maxillofacial Surgery Department of People’s Dental Academy, Bhopal. Our results resemble with current knowledge of odontogenic microbial flora. In this study, frequently isolated isolates were 40 (51%) of *Staphylococcus aureus* isolates, 65 (83%) of *Streptococcus mutans*, 23 (29%) of *Streptococcus salivarius*, 30 (38%) of *Streptococcus sanguis*, 21 (27%) of *Streptococcus mitis*, 17 (22%) of *Pseudomonas aeruginosa*, and 14 (18%) of *Klebsiella pneumoniae*. The average sensitivity of antimicrobials against all isolated organisms was studied and it was found that common sensitive antimicrobials were clindamycin (88%), metronidazole (79%), cefotaxime (72%), linezolid (72%), erythromycin (72%), amoxiclav (71%), ornidazole (67%), ciprofloxacin (67%), vancomycin (65%), imipenum (64%), cefadroxil (59%), cefazidine (59%), azithromycin (58%), and cefoperazone sulbactum (56%), whereas resistant antimicrobials were penicillin (83%), levofloxacin (79%), gentamycin (77%), penicillin G (72%), cefuroxime (72%), ceftriazone (65%), ampicillin (65%), amikacin (64%), norfloxacin (59%), piperacillin (56%), clarithromycin (55%), ofloxacin (55%), ampicillin sulbactam (51%), azithromycin (50%), ampicillin sulbactum (50%), and ceftazidine (50%).
**REW-01**

**The Topical Drug Delivery of Itraconazole Microspheres by Solvent Evaporation Method**

Ankita Mandal, Arti Majumdar, Neelesh Malviya

*Department of Pharmacy, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India*

**Address for correspondence:** Ankita Mandal, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India. E-mail: ankitmangal75@gmail.com

Itraconazole is a broad-spectrum antifungal agent, and it belongs to the triazole group which is used in the treatment of local fungal infection. Itraconazole has a poor aqueous solubility and on oral administration results in poor bioavailability and interindividual variation in the plasma drug concentration. Itraconazole doses form are available in the market as tablets, capsules taken by oral route there have some disadvantages like abdominal pain, nausea, vomiting, diarrhoea, menstrual disorders, rash, jaundice, hypokalaemia. Itraconazole is a topical antifungal agent used in fungal pathogens including *Aspergillus* species.

**REW-02**

**Mode of Action of Different Turmeric Derived Curcumin and Curcuminoid Formulations on the Neurodegenerative Disorder, Alzheimer’s**

Anjali Chandani

*Department of Pharmacy, VNS Faculty of Pharmacy, VNS Group of Institutes, Neelbad, Bhopal, Madhya Pradesh, India*

**Address for correspondence:** Anjali Chandani, VNS Faculty of Pharmacy, VNS Group of Institutes, Neelbad, Bhopal, Madhya Pradesh, India. E-mail: chandanianjali1asv@gmail.com

Both curcumin and curcuminoids are chemical derivatives of turmeric. When given in combination they are much more effective in comparison to curcumin alone. Curcumin constitutes 3.14% (on average) of powdered turmeric, having variations in content among the species of *Curcuma longa*. The drug epitomizes the major effect of naturally available medicines on major disorders and proves to be the cure of many diseases. It has many major properties such as it is an antioxidant, anticancer, antitumor, cardioprotective effects, radiosensitizing effects, and many other major effects. The diseases that are mainly due to the damage of peripheral cells and brain cells strongly linked by age and can be prevented by adapting a healthy lifestyle which includes turmeric as a part of our daily supplement. The article reviews the major effect of curcumin and curcuminoids formulations along with their MOA on Alzheimer’s. The effect of these drugs can be seen on some of the major causes of the disease and can be studied in many researches of today.
REW-04

Herbal Drug Use as a Pharmaceutical Bioavailability Enhancer

R. Punasiya, J. Choudhary, N. Solanki, S. Pillai

Department of Pharmacy, GRY Institute of Pharmacy Borawan, Khargone, Madhya Pradesh, India

Address for correspondence: R. Punasiya, GRY Institute of Pharmacy Borawan, Khargone, Madhya Pradesh, India. E-mail: rakeshpunasiya@yahoo.com

Today, there is a great interest and medical need for the improvement of bioavailability of a large number of drugs which are poorly bioavailable, given for long periods, and are toxic and expensive. A bioenhancer is an agent capable of enhancing bioavailability and bioefficacy of a particular drug with which it is combined, without any typical pharmacological activity of its own at the dose used.

REW-06

A Review: Role of Nanoparticle in Herbal Formulation

Ruhee Jain

BM College of Pharmacy

Address for correspondence: Ruhee Jain, BM College of Pharmacy. E-mail: ruhee@gmail.com

In past few years, herbal medicine is in high demand throughout the world, especially in India. Utilize of herbal medicines has greater than before because of their ability to treat special diseases with fewer side effects. In current years, nanotechnology has become one of the most important and exciting front position fields in science. The novel drug delivery systems can significantly increase the pharmacokinetics (reduces dosage frequency and increases the solubility) and therapeutic index of plant origin drugs (absorption whereas decreases elimination). This review article will provide a concise discussion of nanoparticles formulation, and its future impact of nanotechnology on smart herbal drugs.

REW-07

Formulation, Development, and Evaluation of Nanomiemgel for the Treatment of Skin Disease: A Review

Shikha Jaiswal¹, Revathi A. Gupta²

¹Department of Pharmaceutics, Dr. A.P.J. Abdul Kalam University, Indore, Madhya Pradesh, India, ²Department of Pharmaceutical Chemistry, Dr. A.P.J. Abdul Kalam University, Indore, Madhya Pradesh, India

Address for correspondence: Shikha Jaiswal, Department of Pharmaceutics, Dr. A.P.J Abdul Kalam University, Indore, Madhya Pradesh, India. E-mail: jaiswalshikha15@gmail.com

In developing countries occur many types of health issue or various types of disease due to environment, incompatible diet and faulty foods. Among of disease one of the skin disease are numerous and a frequently occurring health problem affecting all
ages from neonates to elderly and cause harm in number of ways. There is number of skin diseases occur such as rashes, viral bacterial, fungal infections, and cancer. In present methodology is to formulate, develop and evaluate of nanomiemgel (NMG) for the treatment of skin disease. NMG consist of two matrices A and B where matrix A is nanoemulsion while matrix B is nanomicelle novel drug delivery system is better than conventional drug delivery system. NMG is to develop a combination therapy as well as topical drug delivery system. The absorption of the combined system would be better than either of the individual drug delivery systems due to maximum possible paths of absorption available for that particular drug. The purpose of this study is to minimize toxic effect, reducing dosing frequency, better therapeutic effect, increase bioavailability, etc. Nanoparticulate systems to expect would be better skin permeation.

REW-08

A Review on Antidepressant Activity of Beta-carotene

Shuchi Jain, Deepak Birla, Vimukta Sharma

Department of Pharmacy, BM College of Pharmaceutical Education & Research, Indore, Madhya Pradesh, India

Address for correspondence: Shuchi Jain, BM College of Pharmaceutical Education & Research, Indore, Madhya Pradesh, India. E-mail: shuchijain33@gmail.com

Depression is a psychiatric disorder, which affects 21% of the world population. The presently using drugs can impose a variety of side effects including cardiac toxicity, hypopiesia, sexual dysfunction, body weight gain, and sleep disorder. During the past decade, there is a growing interest in the therapeutic effects of natural products on mental disorders. Beta-carotene was investigation for antidepressant activity. Beta-carotene significantly reversed stress-induced increase in brain catalase, monoamine oxidase, thiobarbituric acid-reactive substances, and plasma nitrite and corticosterone levels, and increased stress-induced decrease in reduced glutathione levels.

REW-09

Iontophoresis Facilitated Ocular Drug Delivery: A Review on Recent Advancement and Future Prospective

Shweta Awasthy, Prakash K. Soni

Department of Pharmacy, Nanotechnology Research Lab, Shri G.S. Institute of Technology & Science, Indore, Madhya Pradesh, India

Address for correspondence: Prakash K. Soni, Department of Pharmacy, Nanotechnology Research Lab, Shri G.S. Institute of Technology & Science, Indore, Madhya Pradesh, India. E-mail: soniprakashpharma@gmail.com

Iontophoresis or electrically assisted system is a novel non-invasive, needle-free, and effective technique for drug delivery. Ocular iontophoresis is a fast, safe, and painless approach for delivering low-permeable substances by the means of low intensity electric current which leads to enhancement of trans-corneal drug permeation and thereby, extend the duration of drug action. Iontophoresis technique is based on the fundamental principle of physics that same ionic charges repels, and opposite charge attracts each other. The transport mechanism by which ocular iontophoresis may work is electrorepulsion and electroosmotic flow. There are various iontophoretic devices for ocular delivery available in the market. Most commonly used devices are Eyegate® II delivery system and OcuPhore® delivery system and other similar once are visulex™ for ophthalmic drug delivery purpose. The two approaches for iontophoresis are trans-scleral and trans-corneal on the basis of application site. This review is aimed to provide comprehensive information on development of ophthalmic iontophoretic devices, principle, and factors that may affect the performance of iontophoretic drug delivery, therapeutic application, and future prospects.
REW-10

**Cosmeceuticals: A Novel Approach in Skin Care**

**Alisha Jain¹, Neelesh Malviya²**

¹Department of Pharmaceutics, Research Scholar, Mandsaur University, Mandsaur, Madhya Pradesh, India, ²Department of Pharmaceutics, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

**Address for correspondence:** Alisha Jain, Research Scholar, Mandsaur University, Mandsaur, Madhya Pradesh, India. E-mail: jain.alisha2011@gmail.com

Cosmeceuticals are future generation of skin care. They are typically cosmetic-pharmaceutical hybrids intended to enhance the health and beauty of skin. These products contain active ingredients that act on the skin cellular structure through topical application with therapeutic, disease-fighting, or healing properties. Skin disease is a common ailment and it affects all ages. The present text aims to highlight the recent advances in skin cosmeceuticals and explore the existing class of naturally bioactive compounds, which have diverse functional roles and properties that can be used for the development of novel cosmeceuticals.

REW-11

**Liquisolid Technique as a Promising Tool to Enhance Solubility and Dissolution of BCS Class II Drugs**

**Madhavi Kasturi¹, Neelesh Malviya²**

¹Department of Pharmaceutics, Research Scholar, Mandsaur University, Mandsaur, Madhya Pradesh, India, ²Department of Pharmaceutics, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

**Address for correspondence:** Madhavi Kasturi, Research Scholar, Mandsaur University, Mandsaur, Madhya Pradesh, India. E-mail: madhavi2386@gmail.com

Drugs are classified into different classes depending on their solubility and permeability according to BCS Classification System. The BCS Class II drugs face challenging problems in their pharmaceutical product development process due to low solubility and dissolution rates. Hence, they require enhancement in solubility and dissolution rate especially for solid dosage forms such as tablets and capsules. Several conventional methods have been developed earlier for formulation development of BCS Class II drugs. Nowadays, focus is made on new emerging technology called “Liquisolid Technique.” It is considered a new technique to enhance solubility and dissolution profile of poorly water-soluble drugs. These formulations are prepared by mixing liquid medication with carrier (having good absorptive properties) and coating material (having good adsorptive properties) to form dry looking, free-flowing, non-adherent, and readily compressible powder.
A Review on Ficus Palmata

Akansha Porwal, Rakesh Solanki

Department of Pharmaceutics, Mandsaur University, Mandsaur, Madhya Pradesh, India

Address for correspondence: Akansha Porwal, Department of Pharmaceutics, Mandsaur University, Mandsaur, Madhya Pradesh, India. E-mail: akanshaporwal0308@gmail.com

Ficus palmata is an herbaceous perennial plant belonging to the family Moraceae. The fruits of this species resemble those of *Ficus carica*. The plant is regarded as the Indian form or the eastern representative of *F. carica* and some of the figs grown and marketed in Punjab evidently belong to this species. It contains a very juicy fruit and is used for making numerous products such as squash, jam, and jelly from this fruit. The fruits contain mainly sugars and mucilage and are chiefly used as an item of diet in many cases of constipation and within the diseases of the lungs and also the bladder. The ficus palmate plant is employed in various diseases such as gastrointestinal disorders, ulcer, hypoglycemia, hyperlipidemia tumor, diabetes, and fungal infections. Traditionally, stem latex is applied to extract spines deeply lodged within the flesh. The phytochemical screening of the ficus palmata plant extracts showed the presence of alkaloids, cardiac glycosides, terpenoids, flavonoids, and tannins, and aerial parts of ficus palmata utilizing liquid–liquid fractionation and completely different chromatographic techniques resulted within the isolation of a new isomer of psoralenoside particularly, transpsoralenoside as well as one triterpene: Germanicol acetate, one aromatic acid vanillic acid, two furanocoumarins: Bergapten, psoralene, and also the flavones glycoside rutin. The ficus palmata fruit shows antioxidant activity using free radical scavenging and ferric reducing activities. The plant additionally shows *in vitro* antibacterial and antifungal activities of petroleum ether, chloroform, ethyl acetate, acetone, methanolic, ethanolic, and water extracts. Fruit extract was analyzed against cervical cancer cell lines for antiproliferative activity whereas aqueous extract of ficus palmata leaves showed dose-dependent anticancerous action. Ficus palmata total plant extract was found to show hepatoprotective, nephroprotective, antiulcer, and anticoagulant activity.

A Review: Development of Anti-obesity Formulation and its Evaluation Parameters

Jayesh Hada, Parmar Sarjana, Vishal Sharma, Deepak Patidar

Department of Pharmaceutics, B.R. Nahata College of Pharmacy, Mandsaur, Madhya Pradesh, India

Address for correspondence: Vishal Sharma, Department of Pharmaceutics, B.R. Nahata College of Pharmacy, Mandsaur, Madhya Pradesh, India. E-mail: jayesh@gmail.com

The main objective of the study is to review the safety and efficacy of the herbal medicines in the management of obesity in animals and humans for the development of anti-obesity formulation. Obesity characterized as an abnormal increase in fat deposition in adipose tissue and other internal organs. There has been an increase in rates of obese person in both adults (28% increase) and children (47%) in the past 33 years. The imbalance between calories consumed and those which are expended causes the overall energy misbalance and thus weight gain. All of the human and animal studies on the effects of herbs with the key outcome of change in anthropometric measures such as body weight and waist-hip circumference, body fat, amount of food intake, and appetite were included. Of the publications, 50 literatures results were identified and reviewed, and a total of 15 studies were included. Studies with *Erythroxylon monogynum, Cissus quadrangularis* (CQ), *Sambucus nigra, Asparagus officinalis, Garcinia cambogia, Lagerstroemia speciosa*, Gymnema sylvestrae R, ephedra and caffeine, showed a significant decrease in body weight. Chromium picolinate supplementation for overweight or obese adults show too serious side effects above 1000 µg. Dietary fiber including Fenugreek proves to increase the viscosity of stomach contents and reduce fat acid, on the other side Gaur gum has been investigated for its antihyperglycemic and antihyperlipidemic effect on diabetic rats. Flax seeds supplementation improved insulin resistance in obese glucose intolerant people in human study.
Natural Gums and Mucilages as Pharmaceutical Excipients

Kashish Kumar Godawat, Ayush Joshi, Kanchan Dwivedi, Vishal Sharma

Department of Pharmaceutics, B.R. Nahata College of Pharmacy, Mandsaur, Madhya Pradesh, India

Address for correspondence: Kashish Kumar Godawat, Department of Pharmaceutics, B.R. Nahata College of Pharmacy, Mandsaur, Madhya Pradesh, India. E-mail: kashishgodawat@gmail.com

Gums are widely used natural excipients for conventional and novel dosage forms. With the increasing interest in polymers of natural origin, the pharmaceutical world has compliance to use most of them in the formulations. In recent years, there has been a tremendous development in natural products, which are needed to be used for a variety of purposes. Nature has provided us a wide variety of materials to help improves and sustains the health of all living things either directly or indirectly. These natural materials have advantages over synthetic ones since they are chemically inert, non-toxic, less expensive, biodegradable, and widely available. They can also be modified in different ways to obtain tailor-made materials for drug delivery systems and thus can compete with the available synthetic excipients. Moreover, the tremendous orientation of Pharma world toward these naturally derived polymers has become a subject of increasing interest to discover, extract and purify such compounds from the natural origin. Gums are the potent candidates to be used in various pharmaceutical formulations as a potential candidate for novel drug delivery system. In this review, we describe the developments in natural gums for use in the pharmaceutical sciences.

Gynecological Disorders and their Treatment with Herbal Drugs: A Review

Mohd. Talha Niyargar, Chetna Baregama

Department of Medicinal and Pharmaceutical Chemistry, B.R. Nahata College of Pharmacy, Mandsaur University, Mandsaur, Madhya Pradesh, India

Address for correspondence: Chetna Baregama, Department of Medicinal and Pharmaceutical Chemistry, B.R. Nahata College of Pharmacy, Mandsaur University, Mandsaur, Madhya Pradesh, India. E-mail: chetna.baregama@meu.edu.in

Gynecological disorders are disorders of the female genital organs and within it we can talk about sexually transmitted diseases and obstetrics. Their diagnosis and treatment are an important aspect of the quality of life of women and their reproductive health because these disorders are public health and social problem and are very important to deal with them at the level of primary health care, so in this context to promote both primary and secondary prevention. Gynecological disorders include amenorrhea, dysmenorrhea, leukorrheas, menorrhagia, menometrorrhagia, metrorrhagia, oligomenorrhoea, uterine hemorrhage, infertility, spontaneous abortion, postpartum hemorrhage, gonorrhea, and syphilis. Many women do not approach the physicians due to lack of awareness, shyness or hesitation are treated with household remedies in India. A wide range of herbal traditional medicines are used to regulate the menstrual cycle, enhance fertility and as either abortifacients or anti-abortifacients. Plants and plant-based medicaments are the basis of many of the modern pharmaceuticals, we used today for our various ailments. Many herbal drugs which are used for these disorders, for example, *Smilex zeylanica*, *Asparagus racemosus*, *Hemidesmus indicus*, *Euphorbia hirta*, *Woordfordia fruticosa*, *Butea monosperma*, *Saraca asoca*, *Smilex zeylanica*, and *Wendlandia heynei*. Study of phytoconstituents of these drugs which are responsible for their activity is big topic of concern for making their synthetic products so that they can come to the market as brand product and easily available to each woman.
REW-16

A Systematic Comprehensive Scientific Investigation of Computer-aided Drug Design in Fighting Against Diabetes Mellitus: Success, Limitations, and Future

Soni Priyanka¹², Joshi Ankur³, Malviya Neelesh², Sainy Jitendra¹

¹School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India, ²Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India, ³Modern Institute of Pharmaceutical Sciences, Indore, Madhya Pradesh, India

Address for correspondence: Soni Priyanka, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India. E-mail: priyanka2704@gmail.com

Diabetes mellitus is said to be the world most threatening disease of the decade. It is a complex, progressive disease characterized by insulin deficiency and insulin resistance or both. It is recognized as epidemic by the World Health Organization and according to the current facts from year 2016, the WHO estimated that the number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014. In 2015, an estimated 1.6 million deaths were directly caused by diabetes. Another 2.2 million deaths were attributable to high blood glucose in 2012. According to the international diabetes federation 1 in 11 adults have diabetes (415 million) in 2015 but by 2040, 1 adult in 10 (642 million) will have diabetes. Hence, diabetes is said to be the global health emergency of the 21st century. The modern technical tools like computer-aided drug design can give a huge contribution in fighting against such stressed conditions. Here, in this scientific investigation, a systematic effort has been made to analyze the data related to achievements of computational chemistry and bioinformatics to prevent diabetes.

REW-17

A Review on Sustained-release Tablets

Shivani Soni, Madhavi Kasturi, Neelesh Malviya

Department of Pharmaceutics, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

Address for correspondence: Shivani Soni, Department of Pharmaceutics, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India. E-mail: shivani@gmail.com

Oral drug delivery is the most preferred route for administration of various drugs. Sustained-release products provide advantage over conventional dosage form by optimizing bio pharmaceutics and pharmacokinetics properties of drug. Thus, sustained-release formulation provides important means to decrease the side effect of drug by preventing the fluctuation of the therapeutic concentration of the drug in the body. The “sustained-release” is known to have existed in the medical and pharmaceutical literature for many decades. Oral drug delivery is the most preferred route for the various drug molecules among all other routes of drug delivery, because ease of administration which leads to better patient compliance. Orally, administered sustained-release tablets have proven an alternative way to decrease the side effects of drug by avoiding the fluctuation of the therapeutic drug concentration in the body.
Hair, one of the vital parts of the body consequent from ectoderm of skin, is defensive appendages on the body and considered accomplice structure of the integument. Hair fall was in the earlier days recognized as a sign of aging and was a cause for a great deal of awkwardness. Hair growth is divided into three phases: Anagen, catagen, and telogen. Contrasting hair follicles of other animals, the hair follicles of humans are not in the same rotation at the same time; each follicle has its individual program. Management of hair fall is extremely multifaceted. The long-established system of medicine in India acclaims a number of herbal drugs for hair growth endorsement. Natural products are very well-liked and well acknowledged in the cosmetic and hair care industries and about 1000 plant extracts have been examined for hair care treatment. There are many products available in the market, which are prepared by combination of one or more herbal drugs and find acceptability as hair growth promoter. Herbal cosmeceuticals provide a new revolution for hair growth. This review focuses on few natural treasures of herbal drugs into suitable cosmetic formulations that aim to find acceptability as hair growth promoters.

Acne is an inflammatory disease of sebaceous follicles of skin. The current study was conducted to formulate and evaluate the topical herbal anti-acne formulation of marigold extract. The antibacterial activity of ethanolic extract of marigold against acne vulgaris was investigated using disc diffusion method and minimum inhibitory concentration was determined by agar dilution method. Different types of formulations water in oil (W/o) herbal cream, namely formulation 1 to formulation 4 were formulated by incorporating different concentrations of Marigold, Tulsi, and Turmeric from powdered form. The finished formulations give a pale yellowish color cream. The evaluations of all formulations were done on different parameters such as pH, texture changes, and color changes to examine the physical stability of formulations in which these tests were conducted for 10 days at cool temperature of 5°C, for 10 days in room temperature of 35°C, and for 10 days in elevated temperature of 40°C. Moreover, evaluations of antimicrobial activity of all formulations were done. All the formulations showed optimal pH and physically stable. This indicates that the formulations can be used for topical dosage form.
REW-20

Molecular Modeling Study of Bioisosteres of Hydantoin as Potent Aldose Reductase Inhibitor

Jyoti Pandey¹, Ritu Gilhotra¹, Arun K. Gupta²

¹School of Pharmacy, Suresh Gyan Vihar University, Jaipur, Rajasthan, India, ²Department of Pharmaceutical Sciences, RKDF Institute of Pharmaceutical Sciences, Indore, Madhya Pradesh, India

Address for correspondence: Jyoti Pandey, School of Pharmacy, Suresh Gyan Vihar University, Jaipur, Rajasthan, India. E-mail: j.pandey3@gmail.com

This review intend to reveal the function of bioisosterism in designing of new drug molecule as aldose reductase inhibitors with modification and optimization method aiming to get better pharmacokinetic and pharmacodynamic properties of lead. Bioisosteric substitution is not easy; they are to start with analysis of structures, solubility, and electronic parameters to find molecules having parallel biological activity. Rhodanine contain Epalrestat is the only marketed drug also a bioisosters of hydantoin have desirable effect against diabetic neuropathy. This flexibility may well explain the designing of possible substrates for AR.

REW-21

Topical Drug Delivery by Nanostructured Lipid Carriers for the Treatment of Skin Cancer

Arti Majumdar¹,², Nidhi Dubey¹, Neelesh Malviya²

¹School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India, ²Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

Address for correspondence: Arti Majumdar, School of Pharmacy, Devi Ahilya Vishwavidyalaya, Indore, Madhya Pradesh, India. E-mail: artijmajumdar10@gmail.com

Skin cancer represents the most common type of cancer having a very high rate of incidence. Currently available topical treatments for nonmelanoma skin cancer and their precursor lesions, such as active keratoses include semisolid formulations of 5-fluorouracil, diclofenac, and imiquimod. Another topical treatment also used and approved by the US Food and Drug Administration is photodynamic therapy using photosensitizing agent like aminolevulinic acid to kill carcinogenic cells when exposed to light of certain specific wavelength. However, these conventional treatments are associated with various side effects such as severe inflammation, pain, long duration of treatment, and unappealing scars leading to non-acceptance by the patients. The topical administration of anticancer drugs through nanostructured lipid carriers is beneficial in terms of reduced side effects, reduces degradation, enhanced penetration of the drug through the stratum corneum and thus increased drug targeting and therapeutics. As nanostructured lipid carriers (NLCs) are composed of solid lipids and liquid lipids have lots of imperfections to accommodate large amount of drug as compared to SLN. Being lipid-based drug delivery systems, NLCs have been proved as effective carriers for cytotoxic drugs because of their potential to increase the solubility and bioavailability of poorly water-soluble and lipophilic drugs. The present comprehensive study includes the various problems encountered in cancer chemotherapy and the benefits of NLCs in the drug therapy of skin cancer.
REW-22

Medicinal Uses of Lepidium Sativum: A Review

Prashant Dhanwani, Chetna Baregama, Anju Goyal

Department of Medicinal and Pharmaceutical Chemistry, B. R. Nahata College of Pharmacy, Mandsaur University, Mandsaur, Madhya Pradesh, India

Address for correspondence: Chetna Baregama, Department of Medicinal and Pharmaceutical Chemistry, B. R. Nahata College of Pharmacy, Mandsaur University, Mandsaur, Madhya Pradesh, India. E-mail: chetna.baregama@meu.edu.in

*Lepidium sativum* is an annual herb, belonging to Brassicaceae family. In English, it is known as Garden cress which is an annual herb. It is a fast-growing, edible plant botanically related to watercress and mustard. It is also known as Asalio or chandrasur in India, and it is an important medicinal crop in India. Garden cress is a perennial plant, and an important green vegetable consumed by human beings, most typically as a garnish or as a leaf vegetable. *L. sativum* mainly contains alkaloids, saponins, anthracene glycosides, carbohydrates, proteins, amino acids, flavonoids, and sterols as chief phytochemical constituents. Its extracts have been found to possess various pharmacological activities. Folk medicine: The plant is used in Indian folk medicine by the tribals and rural population for a wide spectrum of diseases such as asthma, menstrual cycle regulation, gastrointestinal tract treatment, respiratory infection treatment, immunity booster, hair loss treatment, anticarcinogenic, antipyretic, hepatoprotective activity, antihypertensive, and diuretic activity. All these activities are pharmacologically determined in animals. For many other activities such as antiarthritis, brain intellect enhancer, and effect on growth hormones, garden cress is used as folklore medicine, but phytoconstituent responsible for that and pharmacological activities still not approved.

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REW-23

Antimicrobial Potential of Tagetes Erecta Leaves Silver Nanoparticles and its Antioxidant Activity

Deepa Varandani¹, Disha Jain², Sourabh Jain²

¹Department of Pharmacy, Pinnacle Biomedical Research Institute, Bhopal, Madhya Pradesh, India, ²Department of Pharmacy, APJ University, Indore, Madhya Pradesh, India

Address for correspondence: Disha Jain, Department of Pharmacy, APJ University, Indore, Madhya Pradesh, India

Nanotechnology is the technology employed for the synthesis of nanosized (10–9 m) particles and use of these particles in various therapeutic, diagnostic purposes, material sciences, and engineering. Nanosilver particles are among the most attractive nanomaterial which has been widely used in range of biomedical applications including diagnosis, treatment, drug delivery, medical device coating, and also for personal health care. With the increasing application of nanosilver particles in medical context, it is becoming necessary for a better understanding of mechanism of nanosilver particle’s biological interactions and their specific potential toxicity. Various routes are used for synthesis of nanosilver particles such as physical, chemical, and biological or green synthesis. In this review, first the green synthesis of nanosilver particles was done using tagetes erecta leaf extract and then its antimicrobial and antioxidant activity is studied which can be applied for various diagnosis and treatment of infections.
REW-24

A Review on Plant Essential Oils as Mosquito Repellent

Deepak Kumar Gupta, Manohar Chouhan, Revati Gupta
Department of Pharmaceutics, Dr. A.P.J Abdul Kalam University, Indore, Madhya Pradesh, India

Mosquitoes are small, midge-like flies that constitute the family Culicidae. Which transmit extremely harmful diseases such as malaria, yellow fever, Chikungunya, West Nile Virus, dengue fever, filariasis, Zika virus, and other arboviruses, rendering it the deadliest animal family in the world. Essential oils belonging to various plant species and possessing mixtures of hydrocarbons have been seen to act as effective repellent against various pests. Essential oils are volatile mixtures of hydrocarbons with a diversity of functional groups, and their repellent activity has been linked to the presence of monoterpenes and sesquiterpenes. The commercially marketed repellents basically consist of essential oils from plants Cymbopogon nardus, Eucalyptus maculata, Cymbopogon excavatus, Mentha piperita, and Azadirachta indica. The present article envisaged to review the reports of essential oils on its effectiveness as repellent.

REW-25

Biological and Medicinal Significance of Chalcone: Current Challenges and Future Prospectus

Khushbu Jain, Ankit Agrawal, Neetesh K. Jain, M. K. Gupta, Sanjay Mishra
Oriental College of Pharmacy and Research, Oriental University, Indore, Madhya Pradesh, India

Address for correspondence: Khushbu Jain, Oriental College of Pharmacy and Research, Oriental University, Indore, Madhya Pradesh, India. E-mail: khushbujain599@gmail.com

Chalcone is open chain flavonoids. Chalcone is most important nucleus because it holds various biological activities including antitumor, antifungal, antiviral, and anticancer. Chalcones are starting material for various heterocyclic nucleuses which exert different pharmacological activities.

REW-26

Prediction of Diabetes Mellitus Using Cheminformatics

Monish Gupta, Ankit Mangal
Department of Pharmaceutics, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

Address for correspondence: Ankit Mangal, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India. E-mail: ankitmangal75@gmail.com

Diabetes is a metabolic disorder associated with either improper functioning of the beta-cells or wherein cells fail to use insulin properly. Insulin, the principal hormone regulates uptake of glucose from the blood into most of the cells except central nervous system. Therefore, deficiency of insulin or the insensitivity of its receptors plays a key role in all forms of diabetes. In the present work, the cheminformatics is widely used for many serious disease treat by the change in the chemical and their information. The cheminformatics is consist of chemical and knowledge about chemical.
REW-27

Liver Cirrhosis and Herbal Remedies

Vivek Kumar, Anindya Goswami, Neelesh Malviya

Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

Address for correspondence: Vivek Kumar, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India. E-mail: Kumarvivek.sign4321@gmail.com

Cirrhosis is a difficulty of liver disease which involves loss of liver cells and permanent scarring of the liver. Alcohol and viral hepatitis B and C are general causes of cirrhosis, even though there are loads of other causes. Cirrhosis can cause weakness, hammering of appetite, easy stain, jaundice, burning, and weariness. Management of cirrhosis is considered to prevent advance damage to the liver, take care of difficulties of cirrhosis, and preventing or detecting liver cancer early on. Transplantation of the liver is an imperative alternative for treating patients with advanced cirrhosis. A good number of researchers studied the effects of some herbal remedies and found that some plants effectively helped improve patients suffering from cirrhosis of the liver. The available herbal remedies for cirrhosis that may be helpful in halting this disease progression usually have anti-inflammatory properties. It is critical that herbal remedies for cirrhosis should be used only by patients that have first consulted with a physician or other health care provider.

REW-28

Herbal Therapy for Gynecological Disorders

Shweta Shriwas1, Raju Chouksey1, Sumeet Dwivedi2

1Department of Pharmacy, Dr. A.P.J Abdul Kalam University, Indore, Madhya Pradesh, India, 2Department of Pharmacognosy, Swami Vivekanand College of Pharmacy, Indore, Madhya Pradesh, India

Address for correspondence: Shweta Shriwas, Department of Pharmacy, Dr. A.P.J Abdul Kalam University, Indore, Madhya Pradesh, India. E-mail: herbal0914@rediffmail.com

Gynecologic disorders are disorders that affect the female reproductive system. The most common symptoms of gynecologic disorders include pelvic pain, vaginal itching, vaginal discharge, abnormal vaginal bleeding, and breast pain. The significance of these symptoms often depends on the woman’s age because symptoms may be related to the hormonal changes that occur with aging. The chief disorders are associated with menstruation, leukorrhea, diseases connected to pregnancy and childbirth, prolapse of the uterus and infertility and frigidity. In modern system of medicine, the drugs often used in the treatment are estrogens, progestrogens, anabolic, and androgenic steroids. These drugs are effective but have a number of side effects such as nausea, vomiting, headache, dizziness, tenderness, and enlargement of breasts. Steroids may produce masculinization in females. In chronic cases, the treatment is obviously prolonged. The herbal system has a number of medicines that not only provide symptomatic relief but also attacks the root cause without any known side effects. Sexually transmitted infections are a major public health problem and are one of the most common causes of illness and even death in the world today. They have far reaching health, social and economic consequences, particularly in the developing world. The present paper review on the herbal therapy for the gynecological disorders. In the present communication, 23 herbs, namely Achyranthes aspera, Guizotia abyssinica, Trachyspermum ammi, Zingiber nummaralia, and Nigella sativa were discussed along with their ethnogynecological importance.
A Comprehensive Review on *Nyctanthes arbor-tristis* Linn

Kalindi Chauhan, Rakesh Solanki

*Department of Pharmaceutics, Mandsaur University, Mandsaur, Madhya Pradesh, India*

**Address for correspondence:** Kalindi Chauhan, Department of Pharmaceutics, Mandsaur University, Mandsaur, Madhya Pradesh, India. E-mail: kalindi2591@gmail.com

*Nyctanthes arbor-tristis* is one among the foremost helpful ancient healthful plants in Asian country. It’s currently considered as a valuable source of many distinctive products for the medicines against numerous diseases and additionally for the event of some industrial product. The assorted elements of plant such as fruits, leaves, seeds, flowers, barks, and stem have vital phytochemicals and have some healthful importance for treatment and management of various disease states. This review explores the published scientific literature of *nyctanthes arbor-tristis* to compile the traditional and scientific information comprising pharmacognostic description, distribution, therapeutic uses, phytochemical constitution, and pharmacologic properties. Phytochemicals responsible for antimalarial, antipyretic, anti-inflammatory, antiviral, hepatoprotective, antifungal, antihistaminic, antibacterial, and antioxidant activities of night Jessamine and emphasizes the necessity for any exploring available data.

Enhanced Production of Plant Secondary Metabolites Through the Use of Biotic and Abiotic Elicitors: A Review

Rajiv Saxena¹, Neelesh Malviya²

¹Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India, ²Mandsaur University, Mandsaur, Madhya Pradesh, India

**Address for correspondence:** Rajiv Saxena, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India. E-mail: rajivbiotech@rediffmail.com

Plants based medicines covers a major segment of Indian health-care system. People are using it to strive good health even in developed countries also. Therapeutic advantages and popularity had led to the growth of many industries involved in the manufacturing and processing of plant-derived formulations. These industries are entirely dependent on the supply of crude drug and phytochemicals. As a result, of which the burden on the availability of the resources is increasing tremendously. Apart from its supply stress the factors like climate change are putting extra burden on existence of rich medicinal plant due to which many rare and even common plant species are on the edge of extinction. Newer technological approaches can help to preserve the valuable plants, and also these methods can contribute in increasing the productivity of plants for phytochemicals in laboratory as well as in field conditions. Use of biotic and abiotic elicitors such as Lantharium, europium, calcium, silver, chitosan, guar gum, pectin, alginate, and salicylic acid can enhance the production of various secondary metabolites by triggering the stress responses. Elicitor works by stimulating the plant immune responses that can lead to the generation of defensive molecules including phytoalexine that can have new or improved pharmacological activities.
Review on Toxicovigilance Study of Herbal Medicines

Neetu Pancholi¹, Neetesh K. Jain², Ankit Agrawal³

¹Department of Pharmacology, Dr. A.P.J Abdul Kalam University, Indore, Madhya Pradesh, India, ²Department of Pharmacology, Oriental University, Indore, Madhya Pradesh, India, ³Department of Pharmacology, Smriti College of Pharmaceutical Education, Indore, Madhya Pradesh, India

Address for correspondence: Neetu Pancholi, Dr. A.P.J Abdul Kalam University, Indore, Madhya Pradesh, India.
E-mail: neetu.pancholi30@gmail.com

Herbal medicines are now in great demand in the developing world for primary health care not because they are inexpensive but also for better cultural acceptability, better compatibility with the human body, and minimal side effects. However, recent findings indicate that all herbal medicines may not be safe as severe consequences are reported for some herbal drugs. Most herbal products in the market today have not been subjected to drug approval process to demonstrate their safety and effectiveness. Thus, toxicovigilance can contribute for toxicological screening, quality control and regulation of herbal drugs including hazard identification and risk assessment by providing medically validated data which are often overlooked in the process of risk assessment. As pharmacist and researchers continue to explore the safety and effectiveness of herbal medicines, more is learned about both their promises and pitfalls. At the same time, legislators at the national level should continue to press for effective laws to protect consumers from potentially harmful herbal drugs.