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FORMULATION AND EVALUATION OF HERBAL CHOCOLATE FROM *PYRUS COMMUNIS* FOR IMMUNITY BOOSTING

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ABSTRACT

A large part of the world consume chocolate at different ages and for different purposes that helped as an impulse for this study. There is globally high demand for chocolate in the market that resulted in potential risks for adulteration of chocolate products. The Immunity Booster Herbal Chocolates is a project that aims to develop a functional confectionery that combines the indulgence of luxurious texture of chocolate along with the health enhancing properties of medicinal herbs. The project focus on developing functional herbal chocolates which is infused with leaf extract of *Pyrus communis* that aims to provide immune support by the help of a confectionery. Leaves of *Pyrus communis* are rich in anti-inflammatory and antioxidant properties that helps in improving the overall health of body. Dark chocolate is itself considered as a functional food due to presence of bioactive compounds like polyphenols and flavonoids while cocoa powder and cocoa butter are rich in antioxidant properties. This is an innovative approach that caters the modern consumer demands and bridges the gap between contemporary dietary trends and traditional herbal medicines. The project involves formulation of herb infused chocolates, evaluation of their sensory attributes and assessment of the potential health benefits. The major goal is to provide a healthful treat which can be integrated into daily diets that supports immune function. In order to provide antioxidant and immunity boosting activity.

KEYWORDS: *Pyrus communis*, Cocoa butter, Herbal chocolate, Immune system.

INTRODUCTION

Chocolate is a beloved confectionery that is enjoyed in whole world, which boasts a rich history, evolving from ancient elixirs to the diverse types of products we use today. The term “CHOCOLATE” is derived from the word ‘coca’. The story of chocolates dates back over 5,000 years ago from the ancient civilizations of Maya and Aztec peoples. The cacao tree is mainly native to Central and South America. The Maya considered cacao as the “food of the gods”, a sentiment echoed in the name of Theobroma.Chocolate is abundant in various phytocompounds like phenyl ethane, flavonoids, methylxanthines, aliphatic alcohols and many more. Phenyl ethylamine, one of the phytocompounds, is known as the “love drug”, which occurs naturally in our brain and is produced when individuals are in love.[1,2]

Evolution of Chocolate Production

The transformation of chocolate from ceremonial and traditional beverage to a mass produced confectionery that also involved significant technological advancements. In 1828, Dutch chemist developed a method for the extraction of cocoa butter from the roasted cacao beans resulting in production of a defatted cocoa powder. This innovation resulted in creation of “Dutch process”, in which cocoa was treated with alkaline salts that improved its solubility and flavor. In 1847, a British chocolatier combined cocoa powder, sugar and melted cocoa butter to produce first solid chocolate bar suitable for human consumption. In 1875, Swiss chocolatier introduced milk chocolate by incorporating the powdered milk that resulted in a creamier and sweeter product.[1] In 1879, the conching machine was invented, that is used to refine chocolate texture by heating and grinding that produces a more smoother and palatable product.

HERB-INFUSED CHOCOLATES

Herb infused chocolates represent a harmonious fusion of the traditional confectionery and the therapeutic benefits of medicinal herbs. Integration of botanical extracts in the chocolate can help satisfy the sweet cravings and also offer potential health advantages, transforming a simple treat into the functional food. The practice of combining of herbs with food for medicinal purpose dates back centuries across various cultures. The Mayans and the Aztecs consumed cacao-based beverages infused with different spices like chilli and vanilla for ceremonial and medicinal purposes. The incorporation of herbs into the chocolate is a contemporary extension of this tradition, which aims to enhance well-being through diet. This innovative approach seeks to marry the incorporation of chocolate with the holistic benefits of the herbal remedies. Herb-infused chocolates blends the rich flavors of cocoa along with the therapeutic properties of different medicinal herbs, that creates confectionery that delights the palate and also offers health benefits.[5,6,7]

Cocoa and its Benefits

Cocoa itself is rich in antioxidants and flavonoids, which contributes to the cardiovascular health and the cognitive functions. When the cocoa is combined with medicinal herbs known for their medicinal properties, the resulting confectionery can offer an additional health benefits, which includes blood pressure regulation and management of weight. These herbal chocolates are often formulated without the indulgence of any synthetic preservatives or emulsifying fats, opting for natural alternatives like cocoa butter and rosemary extract, thereby reducing the potential adverse effects that are associated with artificial additives.

Considerations

Selection of herbs that complement the natural taste of the chocolate is important. For instance, mint, lavender and cinnamon blends well with the cocoa’s profile. Be mindful about the strength of the herbs used as some of the herbs have intense flavor or potent effects. So it is essential to use appropriate quantities of herbs to avoid overpowering the

taste of the chocolate.[10,11] If herbs like cannabis are used, decarboxylation is necessary to activate the compounds. Infusing the herbs in to the fat medium, such as cocoa butter, allows the effective incorporation of herbs in the chocolate which can be achieved by melting the fat, adding the herb and maintaining a low heat to facilitate infusion degradation of properties of herbs.

Pharmacological Assessment

Investigation of absorption, distribution, metabolism and excretion of the bioactive compounds from the pear leaf extract is necessary for the pharmacokinetics when the drug delivered through the chocolate matrix. Conduction of comprehensive safety evaluations to determine any potential adverse effects associated with the consumption of pear leaf-infused chocolates for the safety and toxicological assessment. Performing the randomized, placebo-controlled clinical trials to evaluate the effectiveness of the herbal chocolate in enhancing immune function among the various populations. Assessment of consumer perceptions regarding the taste, texture and overall satisfaction to ensure the product is well-received and to identify factors influencing adherence to recommend consumption patterns for consumer acceptability and compliance.[13,14]

Properties of Chocolate as a Delivery System

The inherent sweetness and creamy texture of the chocolate is used to mask the bitter or unpleasant flavors of certain medications, which enhances patient compliance. Chocolate possess thermal properties like remaining solid at room temperature and melting at body temperature, which helps to facilitate release of incorporated drug upon ingestion. Due to the anhydrous nature of the chocolate, it resists the microbial growth as well as prevents the hydrolysis of water-sensitive active ingredients, resulting in enhancement of stability of the medication.

Medicated Chocolates: Medicated chocolates have been explored as a means to administer various types of drugs to children which aims to improve adherence to treatment regimens. For example, formulations containing anti-parasitic agents like albendazole have been developed, which demonstrates the feasibility of this approach. The familiar and enjoyable nature of the chocolate helps to reduce resistance to medication intake, simplifies the administration process for healthcare providers.[15,16]

Pyrus communis

Pyrus communis, commonly known as the common pear and European pear, is a deciduous tree that belongs to the family of Rosaceae. Beyond the culinary appeal of the tree, this species boasts a rich history, diverse cultivars and significant ecological contributions. The plant is renowned for its sweet and grainy textured fruits that has been cultivated for thousands of years and holding significant cultural, economic and ecological value. *Pyrus communis* is native to the central and Eastern Europe as well as the western Asia. Many archaeological evidence suggests that the pears were collected from the wild long before their cultivation. The common pear tree is typically 2 to 20 meters in height and could live up to 250 years. The plant has deep, woody root system and also have an erect trunk with grey and fissured bark.[13,16]

Essential Minerals

Pears are rich source of essential minerals like copper and potassium. Copper plays a role in immunity, cholesterol metabolism, and nerve function, while potassium helps to aid in muscle contractions and functioning of heart. Pear

leaves contain arbutin, that has been used to defend against the bacterial infections, which helps to support the immune system by reducing the burden of pathogens.

Culinary Uses

Pears are the versatile ingredients in the kitchen where they are used in dishes such as poached pears and tarts. Pears are commonly canned, dried or incorporated into jams that helps to extend their availability beyond their harvest season. The tress are also used in beverage production by fermenting the pear to produce an alcoholic beverage. *Pyrus communis* majorly thrives in temperate climates with sufficient winter chilling, minimal late frosts and sunny springs. The tree prefers light and deep soils that can also tolerate various soil types, including clay. For the optimal fruiting, planting two or more varieties together helps to facilitate cross pollination.[17,18]

Applications of Pear Leaf

1. Anti-inflammatory

The anti-inflammatory effect of pear leaves have also shown other health benefits like reduced risk of chronic diseases, improved health of joints, reduced pain and inflammation, improved skin health and boosted immune function. The anti-inflammatory compounds present in pear leaves also help in reduction of inflammation throughout the body, including the blood vessel inflammation, which indirectly helps to reduce the risk of cardiovascular events like heart attack or strokes. Pear leaves are rich in anti-inflammatory nutrients like flavonoids and terpenoids that have potent anti-inflammatory effects, both in vitro and in vivo. One of the recent studies found that the pear leaves extract reduce inflammation significantly in a of mouse model of arthritis. The extract of the pear leaf found to inhibit the production of pro-inflammatory cytokines and promotes the production of anti-inflammatory cytokines. Another scientific study found the effect of pear leaf extract on reducing inflammation in a human model of skin irritation. The extract helped to reduce redness, swelling and also itching.

2. Antioxidant

Pear leaves are rich in different nutrients like Vitamin C, Potassium, Fiber, Antioxidants. Vitamin C is an antioxidants that helps in protection of cells from damages by the help of free radicals, while Potassium helps to regulate blood pressure and heart function. Pear leaves are also rich in different antioxidant compounds like flavonoids, phenolic acids and tannins. These antioxidant compounds play a crucial role in the protection against the oxidative stress which is a condition caused due to imbalance between production of free radicals and the ability of the body to counteract their harmful effects. The antioxidant compounds of the pear leaves fights the free radicals through different mechanisms. Firstly, they act as the free radical scavengers, which directly neutralize free radicals and helps preventing them from causing any damage to the cells and tissues. Secondly, they inhibits the production of free radicals by the mechanism of interfering with the enzymes and pathways which are involved in their generation. Third mechanism is to enhance the natural antioxidant of the body's defense system like glutathione and superoxide dismutase, which helps in neutralizing the free radicals and repairing the oxidative damage.[19,20]

3. Cardiovascular Health

Pear leaves are also studied for their potential benefits in maintaining the cardiovascular health. They have unique composition which contributes to regulate blood pressure, improve the lipid profiles and also reduce the risk of cardiovascular events. Potassium is one of the key component of pear leaves which is essential for its role in maintaining electrolyte balance and regulating the blood pressure in individuals with hypertension. The flavonoid

content in pear leaves have beneficial effects on lipid profiles. These compounds helps to reduce levels of LDL cholesterol also known as “bad cholesterol”, on the other hand helps to increase the levels of HDL cholesterol which is known as the “good cholesterol”. By improving the lipid profiles, pear leaves helps to reduce the risk of development of diseases like atherosclerosis and coronary artery disease.

4. **Immunity Boosting**

Pear leaves have been used traditionally for a long time for different purposes like reduction of inflammation, treatment of wounds and alleviating digestive issues like diarrhoea and constipation. Pear leaves can also be incorporated in the dietary supplements or the functional foods that helps to boost the immune system and also protect against the infections. The compounds present in the pear leaves help to support the healthy digestion by stimulating the production of some digestive enzymes and helps in promoting the breakdown of the food. This helps to prevent indigestion. Gastric acidity or other digestive discomfort. Pear leaves have been used traditionally as a natural remedy for digestive issues by incorporating them into teas, tinctures and other supplements to alleviate digestive problems.[21,22]

5. **Improving Skin Health**

Pear leaves have been found to possess remarkable properties which may benefit the skin health. The anti-inflammatory and antioxidant properties of the pear leaves helps to soothe irritated skin, reduce acne and improve overall skin appearance. The flavonoids and tannins compounds help to calm the inflamed skin and reduce redness. Various scientific studies have found to show that the pear leaf extracts can reduce inflammation in skin cells and protect against the oxidative damage caused due to free radicals. Pear leaves are a rich source of Vitamin C and quercetin, which helps to protect the skin from any damage caused by environmental stressors like the UV radiation and pollution. These antioxidant compounds neutralize free radicals, which can also damage skin cells and then lead to premature aging and wrinkles. The combination of these anti-inflammatory and antioxidant properties helps to reduce blemishes, smoothing fine lines, enhances skin elasticity which improves skin appearance. The extract also inhibits the production of melanin, which helps to reduce hyperpigmentation and dark spots.[25,26]

Size and Growth Habit: The common pear grows up to the heights of 10-20 m, though in cultivation, it is often maintained at 3-5 m. It exhibits a pyramidal and crown head.

Leaves: The leaves of the tree are alternately arranged with ovate to elliptical in shape. The size measures 2.5-10 cm in length and 3-5 cm in width. The margin is finely serrated with glossy dark green surface above and paler and dull below.

Flowers: The flowers are white or pale pink in color and the inflorescence is arranged in corymbs on spur-like branches. The flowers are 5-petaled, measuring 2-3 cm in diameter.

Fruit: The fruit is typically pear-shaped with a rounded bell at the bottom and a smaller neck or stem end. The fruit is green when unripe and turns yellow upon ripening with juicy and sweet taste.

Bark and Branches: The bark is grey-brown with shallow furrows and flat-topped scaly ridges while the branches are formed short, stiff spurs and can be spiny.

COCOA POWDER

MORPHOLOGICAL CHARACTERISTICS

Leaves: The leaves of Theobroma cacao exhibits several distinctive morphological characteristics with varying size, shape, color and texture. The leaves of the tree are large, oblong to elliptical in shape, measuring approx. 17-28 cm in length and 7-10 cm in width. Young leaves of the tree emerges with a red hue and drooping posture, which is mostly believed to deter herbivores. As they mature, the leaves transition to a dark green color with shiny and leathery texture. The leaf apex are typically acute to broadly acute and the base is obtuse. The leaves have prominent in reticulate venation pattern, with a midrib and nerve prominently ridged on the underside. Each leaf is attached to the stem by the petiole which is equipped with two articulations located at the base and the tip. These articulations allow the leaf to adjust its orientation in response to sunlight.[28,29]

Flowers: The flowers of the Theobroma cacao tree are smaller in size, approx. 1 cm in diameter and displays a unique radical symmetry. The color of the flowers ranges from yellowish-white to pale pink and grow directly from the trunk and mature branches by the phenomenon of cauliflory. Cacao flowers are protandrous which means that they first release pollen before becoming receptive to it and they open at night with receptivity during the day. They are typically pollinated by tiny flies like midges from the genus Forcipomyia. Studies have identified diversity in the shapes of cacao flowers including forms like oval, broad, deltoid, elliptic and sub-lanceolate.[30,31]

Fruits: The fruit of Theobroma cacao also known as cacao pod typically measures between 15 to 30 cm in length and 7-10 cm in width. Their shape ranges from spherical to oblong, featuring 5-10 longitudinal ridges. The unripe pods of the tree are generally green or white, maturing to hues of yellow, orange, red or purple depending on the variety. The texture of the surface of the pod varies among different cacao types like some have large pods with rough husk or melon shaped with hard woody shell. Each pod contains approx. 20-60 seeds known as cocoa beans which are enveloped in a sweet, white pulp known as mucilage.

Roots: The roots of the cacao tree are shallow and wide spreading which helps to anchor the tree in the soil and absorbs the nutrients and water.

STEVIA

MORPHOLOGICAL CHARACHTERISTICS

Growth Habit: Stevia is an erect growing plant which reaches heights up to 20-30 cm. It can grow up to 74 cm in its native habitat

Leaves: The leaves of the plant are simple, oblong to lanceolate and measures approx. 2.5-6 cm in length and 2.5-3.5 cm in width. The leaves are arranged oppositely along the stems and possess serrated margins. The surface of the leaf is covered with the trichomes, including glandular and non-glandular types.

Flowers: Stevia have small, white and tubular flowers approx. 8-15 mm in diameter and are grouped in terminal panicles. Each flower head contains five disk florets and the flowers are hermaphroditic with both male and female reproductive organs. The inflorescence of stevia plant is paniculate.

Fruits and Seeds: The fruit of the plant is a type of achene with approx. 3 mm in length, containing a single seed. Each seed is equipped with a feathery pappus which helps in wind dispersal.[32,34,35]

MATERIALS AND METHODS

S.No.	INGREDIENTS	USES
1.	Pyrus communis (Leaves extract)	Active Pharmaceutical Ingredient
2.	Cocoa Powder	Principle Ingredient
3.	Cocoa Butter	Solidifying Agent
4.	Stevia Sugar	Sweetening Agent

COCOA POWDER

Cocoa powder comes from the seeds (cocoa beans) of the Theobroma cacao tree, which belongs to the Malvaceae family.

BOTANICAL NAME: Theobroma cacao

FAMILY: Malvaceae

SYNONYMS: Cocoa tree, Cacao tree

CHEMICAL CONSTITUENTS

Polyphenols: The cocoa is rich in high amount of flavonoids, especially flavonols also known as flavan-3-ols. Polyphenols are secondary plant metabolites that are involved in the defense of the plant against herbivores, pathogens and UV damage. Cocoa components are also rich in catechins, and contain smaller amounts of gallocatechin and epigallocatechin. The bitterness is due to the high levels of flavonols which have healing properties and other health benefits.[36,37]

Theobromine: Cocoa contains methylxanthine compounds majorly theobromine and caffeine. It belongs to the group of purine alkaloids which is present in limited no. of plant species. Theobromine stimulates heart muscle and relaxes bronchial smooth muscles in the lungs as well as plays an important role in the transmission of intracellular signals.

Minerals: The cocoa bean is rich in minerals like magnesium, copper, potassium and iron. Dark chocolate is also rich in copper which helps in iron transport, glucose metabolism, infant growth and brain development.

Caffeine: It is present in smaller amounts in comparison to theobromine which helps to influence the stimulating properties of chocolate.[38,39]

COCOA BUTTER

Cocoa butter is derived from the seeds of the cacao tree, a tropical evergreen species known for its distinctive botanical and morphological characteristics.

BOTANICAL NAME: Theobroma cacao

FAMILY: Malvaceae

SYNONYMS: Theobroma oil

Cocoa butter is pale yellow and edible vegetable fat which is obtained from the cocoa beans and have mild chocolate flavor and aroma. The process of extraction of cocoa butter from the beans when the beans are harvested and then fermented. The beans are dried, cleaned, roasted and cracked which consists of both cocoa solids and cocoa butter. Melting of the cocoa butter in chocolate with solidification without tempering leads to the formation of an unstable polymorphic form of cocoa butter. It happens when the chocolate bars melt in a hot room and leads to the formation of white patches on the surface of the chocolate known as chocolate bloom.[41,42,43]

USES

Cocoa butter is used in products like soaps, lotions, cosmetics and lip balms. It is a major ingredient in all types of chocolates, like white, milk and dark chocolate. Cocoa has good stability because it melts around the body temperature. Its antioxidant property prevents rancidity, while its velvety texture, pleasant fragrance and emollient properties are responsible for its incorporation in skin products like soaps and lotions. Pharmaceutical companies uses cocoa butter as an ideal base for medicinal suppositories.[44]

STEVIA

BOTANICAL NAME: Stevia rebaudiana

FAMILY: Asteraceae (Compositae)

SYNONYMS: Sweet leaf, sugar leaf, sweet herb of Paraguay

CHEMICAL CONSTITUENTS

- **Stevioside:** Consisting of 5-10 % of the dry leaf weight, stevioside is a major glycoside which is responsible for sweetness in Stevia.
- **Rebaudioside A:** Present in 2-4% and have sweet taste with minimal bitterness.
- **Rebaudioside C:** Found in concentration of 1-2% in the stevia leaves.

USES: Stevia is used to sweeten the beverages like coffee, tea, lemonade without any added calories. It can be sprinkled on cereals or incorporated into smoothies to enhance flavor. Stevia is used to reduce calorie intake for weight loss by replacing sugar with stevia. Stevia do not contribute calories to the diet, making it suitable sweetener for people with diabetes aiming to control blood sugar levels.[50,51]

BOTANICAL NAME: *Pyrus communis*

FAMILY: Rosaceae

SYNONYMS: common pear, European pear

CHEMICAL CONSTITUENTS

Sugars and Organic Acids: Fructose is predominant in the pulp, seeds and peel along with sorbitol in the leaves. Malic acid is the organic acid present in more concentration than citric and shikimic acid.[52,53]

Phenolic Compounds: Arbutin is phenolic glycoside present in the fruit and leaves, while flavonoids like quercetin, kaempferol are present in the plant in varying concentration. Chlorogenic acid is present in the peel and flesh which has antioxidant activity.[54,55,56]

Triterpenoids: The peel of the pear is rich in triterpenoids like ursolic acid.

USES: The primary use of the plant is for its sweet and juicy fruit, which is consumed fresh worldwide. Pears are used in beverages like pear cider and pear brandy while the fruit can also be incorporated in culinary dishes. Pears are traditionally used to address mild digestion, diarrhoea and constipation, while it protects against oxidative stress due to its antioxidant properties. It also possess anti-inflammatory and antibacterial properties along with management of blood sugar.[45,57,58]

FORMULATION METHOD

S. No.	INGREDIENTS	QUANTITY
1.	Pyrus communis (Leaves Extract)	3 gram
2.	Cocoa Powder	12 gram
3.	Cocoa Butter	15gram
4.	Stevia Sugar	0.1-0.2 gram

EQUIPMENTS

1. Double boiler or microwave safe bowl
2. Chocolate Molds
3. Whisk or Spatula
4. Refrigerator
5. Weighing Balance
6. Water Bath
7. Mortar and Pestle
8. Beaker
9. Stirrer

STEPS FOR PREPARATION

1. Collection and Preparation of Leaves

- Collect fresh, mature pear leaves from the tress that have not been exposed to pesticides or other harmful chemicals.
- Harvest during the early morning when the leaves have potent essential compounds.
- Use clean, sharp scissors or pruning shears to avoid damaging the tree and to ensure clean cuts.[59,60]

2. Cleaning and Drying

- Rinse the collected leaves gently under cool running water to remove dirt and potential contaminants.
- Pat the dry leaves dry with a clean cloth and spread them out in a single layer on a drying rack. Place them in a well-ventilated, shaded area away from direct sunlight.
- Allow them to air dry completely over several days until they become crisp to the touch.[61,62]

3. Preparation of Leaf Powder

- Once dried, the leaves are grinded into a fine powder using a mortar and pestle.
- Pass the ground powder through a fine mesh sieve to ensure uniform particle size.
- Store the pear leaf powder in an airtight container, away from sunlight and moisture.

4. Preparation of Herbal Extract

The extract was prepared using cold maceration extraction method. The solvent used is methanol i.e., 96% methanol and 4% water.[63,64]

Procedure

Place 16gram powdered pear leaves into a clean, sealable container. Add the solvent (96% methanol + 4% water) to the container, ensuring that the plant material is fully submerged. Seal the container and allow the mixture to stand for 72

hours. Shake the mixture periodically. After the maceration period, filter the mixture and concentrate the filtrate by evaporating the solvent under reduced pressure.[65,66]

5. Preparation of Herbal Chocolate

- **Ingredients**
  - Cocoa butter: 15 grams
  - Cocoa powder: 12 grams
  - Pear leaf extract: 3 grams
  - Stevia sugar: 0.1-0.2 grams (adjust to taste)

- **Procedure**
  - Melting: Chop the Cocoa butter in to small pieces for even melting, Place it in the top of a double boiler over the simmering water. Stir gently until fully melted.
  - Mixing: Remove the melted cocoa butter from the heat. Sift in the cocoa powder and whisk until smooth and well combined.[67,68,69]

  - Incorporating Pear Leaf Extract: Gradually add the pear leaf extract, stirring continuously to ensure even distribution.
  - Sweetening: Add the stevia sugar slowly, tasting to achieve the desired sweetness.
  - Molding: Pour the chocolate mixture into the silicone molds, tapping them gently to remove any air bubbles.
  - Setting: Allow the chocolates to set at the room temperature or place them in the refrigerator for quicker solidification.
  - Demolding: Once fully set, carefully remove the chocolates from the molds.

6. Storage

Store the herbal chocolates in an airtight container in a cool, dry place, away from direct sunlight.

PRELIMINARY PHYTOCHEMICAL SCREENING OF EXTRACT

1. Detection of Tannins

Ferric Chloride Test: Boil 0.5 g of powdered pear leaves in 20 ml of distilled water and filter. Add 0.1% ferric chloride to the filtrate. A brownish-green or blue-black coloration indicates the presence of tannins.[70,71]

2. Detection of Phenols

Lead Acetate Test: Dissolve 0.5 g of the extract in distilled water and add 3 ml of 10% lead acetate solution. The formation of a bulky white ppt indicates the presence of phenols.

Detection of Terpenoids: Salkowski Test: Mix 5 ml of the extract with 2 ml of chloroform, then add 3 ml of concentrated sulfuric acid to form a layer. A reddish-brown coloration at the interface indicated the presence of terpenoids.[72,73]

3. Detection of Alkaloids

Mayer's Test: Add a few drops of Mayer's reagent to the extract. The formation of white or yellowish precipitate indicates the presence of alkaloids.

4. Detection of Saponin

Frothing Test: Mix 0.5 g of the extract with 10 ml of distilled water and shake vigorously. The formation of stable, persistent froth indicates the presence of saponins.

EVALUATION PARAMETERS

1. Organoleptic Properties

- **General Appearance:** Assessing the chocolate's color, surface smoothness and overall visual appeal.
- **Taste and Odor:** Ensuring the medicated chocolate has a palatable taste and pleasant odor, masking any undesirable flavor or smell.[74]

2. Blooming Test

- **Fat Bloom**

When a thin layer of the fat crystals forms on the surface of the chocolate formulation, it causes the chocolate to lose its gloss and a soft white layer will appear, giving the finished product an unappetizing look. Fat bloom is caused due to the recrystallization of the fats.

- **Sugar Bloom**

Sugar bloom is a rough and irregular layer on the top of the chocolate, caused due to the condensation (when the chocolate is taken out of the refrigerator). This moisture will dissolve the sugar in the chocolate and when the water evaporated afterwards, the sugar recrystallizes in to rough, irregular crystals on the surface.

3. Hardness Test

Assessing the hardness of herbal chocolate is crucial for ensuring its quality, texture, and consumer acceptability. Hardness testing provides insights into the structural integreity of chocolate and its ability to withstand handling and consumption. The **Pfizer Hardness Tester** is applied to assess the hardness of the herbal chocolates. It operates by placing the sample between its jaws and force is applied manually until the sample breaks.

4. pH Determination

The pH determination of herbal chocolate by using pH paper. On a white tile place a clean pH paper strip. Drop of the sample on the pH paper using the clean dropper. Now observe the changes in the color of the pH paper. Now compare the color obtained on the pH paper with the color shades on the standard pH chart.

5. Stability Testing

Stability testing of the prepared herbal chocolate was performed on keeping the samples at different temperature conditions. The sample of the chocolate was kept in a closed container for 1 month. After one month interval, the sample is tested for its physical appearance and drug degradation.

6. Viscosity Determination

The chocolate base is heated and the viscometer spindle rotates at 20 rpm to measure viscosity by the help of Brookfield Viscometer.

RESULTS

PHYTOCHEMICAL ANALYSIS

S. No.	TEST	OBSERVATION
1.	Ferric chloride test	Deep blue-black coloration
2.	Lead acetate test	Formation of white precipitate
3.	Salkowski Test	No change
4.	Mayer’s test	Formation of yellowish-white precipitate
5.	Frothing test	No change

GENERAL APPEARANCE

Colour: Dark brown

Odor: Pleasant with no burnt scent

Taste: Mildly sweet

Texture: Smooth and uniform

BLOOMING TEST

TEST	RESULT
Fat Bloom	No
Sugar Bloom	No

HARDNESS TEST

The hardness of the herbal chocolate is found to be 0.2 Kg/cm

pH DETERMINATION

The pH of the herbal chocolate was calculated by the help of pH paper and the result was found to be pH = 7

STABILITY TESTING

After a month, the sample is examined for any changes in appearance and signs of drug degradation and the result was found to be no change in the stability of the herbal chocolate.

DISCUSSION

In present age, the herbal products are epitome of safety instead of the synthetic drugs which are also very harmful to human beings and the environment. In today's time, the herbal products are the symbol of the safety in comparison to the synthetic drugs which are regarded as unsafe to human beings and the environment. Even though, herbs have been priced for their medicinal, flavoring and aromatic qualities for centuries. Incorporating herbal extracts in to the chocolate is a burgeoning area of functional food development, which aims to enhance the health benefits of the confectionery by leveraging the bioactive compounds found in the pear tree. Plant extract of pear leaves are rich in phenolic compounds, known for their antioxidant properties. Phenolic compounds are secondary metabolites and plays role in plant defense mechanism. Arbutin has been detected as a major phenolic compound in pear leaves, which contributes significantly to the total phenolic content.

CONCLUSION

Incorporating pear leaf extract into chocolate merges indulgence with potential health benefits, creating a functional confectionery. Pear leaves are notably rich in phenolic compounds, particularly arbutin and chlorogenic acid, which exhibit strong antioxidant properties. Studies have shown that pear leaves contain higher concentrations of these phenolics compared to other parts of the pear tree, contributing to their significant antioxidant capacity. The antioxidant and anti-inflammatory activities of these compounds may contribute to overall health and wellness integrating pear leaf extract into chocolate not only enhances the nutritional profile of the confection but also offers consumers a novel product that aligns with health-conscious trends.

REFERENCES

1. Krati, Dr. Martolia Jaya, et. al, A comprehensive review on in-vitro methods for anti- microbial activity, IP International Journal of Comprehensive and Advanced Pharmacology, 2024; 9(3).
2. Neeru, Shilpi Kashyap, Esha Vatsa, Jitendra Singh and Ankush Sundriyal "Determination of Total Phenolic Content, Total flavonoid Content and Total Antioxidant capacity of different extracts of Roylea elegans Wall. (aerial parts)" World journal of pharmacy and pharmaceutical sciences (WJPPS), 2016; 5(6): 1884-1891.
3. Neeru, Esha Vatsa, Jitendra Singh and Ankush Sundriyal "Pharmacognostic Standardization Parameters of Roylea elegans Wall. (Aerial Parts)" International Journal for Pharmaceutical Research Scholars (IJPRS), 2016; 5(2):133-140.
4. Kundan Singh Bora and Esha Vatsa "Pharmacognostic Evaluation of Dendrobium macraei Lindl." Universities Journal of Phytochemistry and Ayurvedic Heights (UJPAH), 2016; 1(20):29-36.
5. Amit Sharma, Bharat Parashar, Esha Vatsa, Shilpa Chandel and Surbhi Sharma "Phyto chemical screening and Anthelmintic activity of leaves of Cedrus deodara (Roxb.)" World journal of pharmacy and pharmaceutical sciences (WJPPS), 2016; 5(8):1618-1628.
6. Amit Sharma, Surbhi Sharma, Shilpa Chandel, Esha Vatsa and Dr. Bharat Parashar "A review on Morchella esculanta: Therapeutically Potent plant" World journal of pharmacy and pharmaceutical sciences (WJPPS), 2016; 5(9): 685- 699.

7. Esha Vatsa and Kundan Singh Bora "Memory Enhancing Activity of Dendrobium macraei Lindl. in Swiss Albino Mice" British Journal of Pharmaceutical Research (BJPR), 2016; 13(2):1-11.
8. Vatsa Esha, Chandel Shilpa, Parashar Bharat, Neeru "Physico-Chemical and Phytochemical Evaluation of Dendrobium macraei Lindl. (Whole Plant)" International Journal of Pharmacognosy and Phytochemical Research (IJPPR), 2016; 8(11): 1801- 1811.
9. Esha Vatsa, Mehak Aggarwal, Shipra Gautam "Formulation and Evaluation of Polyherbal Facial Scrub" Just Agriculture multidisciplinary e-Newsletter, Article ID: 023, 2021; 1(9): 1-6.
10. Shipra Gautam, Madhubala Thakur, Mehak Aggarwal, Esha Vatsa"Azadirachta indica- A Review as a Potent Anti-Diabetic drug" Just Agriculture multidisciplinary e-Newsletter, Article ID:98,2021; 1(10): 1-6.
11. Esha Vatsa, Samriti Faujdar, Nidhi Sharma, Shilpa Chandel, Mehak Aggarwal"Dendrobium macraei Lindl.: A review on medicinally potent orchid on the basis of recent evidences" Chinese Journal of Medical Genetics, 2022; 31(3): 560-571.
12. Krati, Babita Rawat, Abhishek Bhardwaj, Amandeep Singh, A Comprehensive Review on Indian Barnyard Millet (Echinochloa frumentacea), International Journal of Pharmaceutical Technology and Biotechnology, 2025; 12(1): 01-07.
13. Krati, Dr. Martolia Jaya, et. al, A Comprehensive review on in-vitro methods for antimicrobial activity" Educational administration: Theory and Practice". 2024; 30(6), 8 (2977-2984).
14. Esha Vatsa, Dr. Samriti Faujdar, Shilpa Chandel, Nidhi Chaudhary, Ashok Kumar, Neeru, "Studies on anti-inflammatory activities of whole plant of Dendrobium macraei Lindl." European Chemical Bulletin, 2023; 12(Special Issue 1): 657-664.
15. Esha Vatsa, Dr. Samriti Faujdar, Nitin Kumar, Nidhi Chaudhary, Shilpa Chandel, Neeru, Mehak Aggarwal "Current studies to justify the medicinal potential of the orchid Dendrobium macraei Lindl." European Chemical Bulletin, 2023; 12(S3): 5822-5830.
16. Divya Negi Rawat, Anjali Bisht, Esha Vatsa, Deepika Chandra, Nidhi Chaudhary, Ashok Kumar "Urinary bacterial profile and antibiotic susceptibility pattern among patients of urinary tract infections" High Technology letters, 2023; 29(10): 115-128.
17. Mehak Aggarwal, Ujjwal Nautiyal, Harmeet Singh, Esha Vatsa, Nidhi Chaudhary, Anjali Bisht, Divya Negi "Development and evaluation of drug delivery system containing luliconazole" High Technology letters, 2023; 29(11): 633-652.
18. Jagriti Gairola, Prashant Kukreti, Anjali Bisht, Divya Negi, Nidhi Chaudhary, Esha Vatsa "Development of Chronotherapeutic Delivery System for the Oral Administration of Aceclofenac for Rheumatoid Arthritis by Using Different Polymers" Journal of Chemical Health Risks, 2023; 13(6): 1180-1192.
19. Nidhi Chaudhary, Dr. Deepak Nanda, Dr. Esha Vatsa, Mithilesh Kesari, Harshita Chandra, Simran Singh Rathore "The Promise of Usefulness of the Evergreen Shrub Cassia auriculata" Journal of Advanced Zoology, 2023; 44(4): 1249-1261.
20. Ms Pooja Yadav, Dr. Esha Vatsa, Dr Arti Rauthan, "Enhancing Menstrual Awareness among Adolescent Girls: Evaluating the Influence of School Initiatives" Journal of Chemical Health Risks, 2024; 14(02): 3141-3149.
21. Mehak Aggarwal, Esha Vatsa, Nidhi Chaudhary, Shilpa Chandel, Shipra Gautam, "Formulation and Evaluation of Polyherbal Face Pack" Research Journal of Pharmacy and Technology, 2024; 17(6): 2481-2485.

22. Esha Vatsa, Mehak Aggarwal, Nidhi Chaudhary, Shipra Gautam, Neeru, Nitin Kumar, "Comparison Based on Pharmacognostical and Pharmacological Profile of Thuja Orientalis Linn. And Thuja Occidentalis Linn.: A Review" Naturalista Campano, 2024; 28(1): 3208-3219.
23. Priya Pandey, Esha Vatsa, Gaurav Lakhchora, Md Shamsher Alam, Niyaz Ahamad Ansari, Mohammad Dabeer Ahamad, Sarafarz Ahamad, Mukul Singh, Nitin kumar, "Nano Medicine Advancements in Addressing Rare Neurological Disorders: A Focus on Globoid Cell Leukodystrophy (Krabbe's Disease) Treatment" African Journal of Biological Sciences, 2024; 6(3): 2654-2684.
24. Esha Vatsa, Nidhi Chaudhary, Priya Khadwal, Mehak Aggarwal, Tanya Aggarwal, and Nishant Bhardwaj, "In vitro Antidiabetic Effect and Phytochemical Screening of Cassia biflora Mill." Indian Journal of Natural Sciences, 2025; 15(88): 87726-87733.
25. Anil Kumar, Dr. Esha Vatsa, "AI-Powered Embryo Selection is revolutionized: A Review" South Eastern European Journal of Public Health, 2025; XXVI (1): 6223-6230.
26. Lohani, V., A R, A., Kundu, S., Akhter, M. Q., & Bag, S. Single-Cell Proteomics with Spatial Attributes: Tools and Techniques. ACS omega, 2023; 8(20): 17499–17510. https://doi.org/10.1021/acsomega.3c00795.
27. Amandeep Singh, Deepak Nanda, Ashok Kumar and Abhishek Bhardwaj . In vitro evaluation of anti-inflammatory activity of ageratum conyzoides leaves by Human Red Blood Cell (HRBC) membrane stabilization method, International Journal of Research in Pharmaceutical and Nano Sciences, 2023; 12(6): 196-202.
28. Amandeep Singh, Deepak Nanda, Ashok Kumar, Abhishek Bhardwaj. In vitro evaluation of anti-inflammatory activity of ageratum conyzoides leaves by Human Red Blood Cell (HRBC) membrane stabilization method, International Journal of Research in Pharmaceutical and Nano Sciences, 2023; 12(6): 196-202.
29. Singh A, Nanda D, Bhardwaj A, Kumar A. A pharmacological investigation for therapeutic potential of Callistemon citrinus as an anthelmintic agent (Bottle-Brush Plant). IP Int J Comprehensive Adv Pharmacol, 2024; 9(3): 206-210.
30. Yogesh Tiwari, Amandeep Singh, Bhupendra Kumar, Ashok Kumar. "In Vitro Evaluation of Alpha Amylase Activity of Bark Extracts of Ficus Auriculata". International Journal of Innovative Science and Research Technology. December, 2017; 2(12): 88-92.
31. Bhupendra Kumar, Amandeep Singh, Yogesh Tiwari, Ashok Kumar. UV PROTECTIVE ACTIVITY OF GLYCINE MAX SEEDS. Indian Research Journal of Pharmacy and Science, 2017;15: 1190-1195
32. Reena Bhatt, Ashok Kumar, Ankita Sharma. FORMULATION AND EVALUATION OF SHAMPOO FORMULATED BY GLYCINE MAX SEEDS.Indian Research Journal of Pharmacy and Science; 15(2017)1232-1238
33. Kumar A, Nanda D and Gupta A . "A Prospective Study on the Risk Determinants and Economic Burden ofAdverse Drug Reactions in Tertiary Care Hospital". Indian Journal of Natural Sciences, 2025;15(88): 87957-87961
34. Ashok Kumar, Deepak Nanda and Abhishek Gupta A holistic approach to adverse drug reactions in hospitals: Classification, risk factors, assessment and economic evaluation- A review. J. Exp. Zool. India, 2024; 27: 2337-2348. DOI: https://doi.org/10.51470/jez.2024.27.2.2337
35. Sakshi Garg, Ashok Kumar, Varsha Deva, Preeti Biswas, Harsh Rastogi, Heena Farooqui. Immediate-Release Drug Delivery System, Current Scenario, And Future Perspective-A Narrative Review. Jundishapur Journal of Microbiology, 2022; 15(1): 6509-6519

36. Ashok Kumar, Deepak Nanda, Abhishek Gupta Pattern of Adverse Drug Reactions and Their Economic Impact on Admitted Patients in Medicine Wards of a Tertiary Care Hospital. Library Progress International, 2024; 44(4): 1120-1139.
37. Alisha Rawat, Meenakshi Sajwan, Yamini Chandola,Nidhi Gaur "Assaultive role of thiamine in coalition with selenium in treatment of liver cancer", Journal of emerging technologies and innovative research, 2022; 9(1); 2349-5162.
38. Ghildiyal, P., Bhatt, A., Chaudhary, N., Narwal, S.,Sehgal, P. "Study of various biochemical parameters on atrazine induced glucose-6-phosphate dehydrogenase deficiency in brain" International Journal of Health Sciences, 2022; 6(S7): 2552-2558.
39. Alok Bhatt, Arun Kumar, Pallavi Ghildiyal, Jyoti Maithani, Nidhi Chaudhary, Manish Nawani, Sonia Narwal "Phytochemical Profile of Melissa parviflora Benth" Neuro Quantology, 2022; 20(9); 2426-2428.
40. Palika Sehgal, Alok Bhatt, Sonia Narwal, Deepak P. Bhagwat, Nidhi Chaudhary et.al Formulation Characterization Optimization and In Vitro Evaluation of Aceclofenac Topical Emulgel, Neuro Quantology, 2022; 20(14): 1-09.
41. Sneha Rawat, Praveen Kumar Ashok, Abhishek bhardwaj "A review on Oro dispersible Tablet of Telmisartan" Org-Journal of Emerging Technologies and Innovative research (JETIR), May 2023; 10(5):i104-i112.
42. Jaison Varghese, Nitin kumar, Sapna Chaudhar, Abhishek Bhardwaj(2024) "Comparative In-Vitro Antioxidant and Antimicrobial Potential of Some Medicinal Plants"African Journal of Biological Sciences, https://doi.org/10.48047/AFJBS.6.Si3.2024.3340-3346.
43. Asima Imtiyaz, Ajay Singh, Abhishek Bhardwaj(2024) "Green synthesis of iron oxide nanoparticles from Iris kashmiriana (Mazar-Graveyard) Plant Extract its characterization of biological activities and photocatalytic activity" Journal of Industrial and Engineering Chemistry, https://doi.org/10.1016/j.jiec.2024.09.004.
44. Hem Chandra Pant, Bhawana Goswami, Ashok Kumar, Abhishek Bhardwaj, Shanti Rauthan and Amita pandey "A Review Paper on Bacopa monniera and Role of Artificial Intelligence (AI) in Medicinal Plant for Management and Treatment of Various Diseases" Indian Journal of Natural Sciences, 2025; 15(88): 01-10.
45. Vishwajeet Bachhar, Vibha Joshi , Ajay Singh,, M. Amin Mir, Abhishek Bhardwaj(2025)"Antibacterial, Antioxidant, and Antidiabetic Activities of TiO2 Nanoparticles Synthesized Through Ultrasonication Assisted Cold Maceration from Stem Extract of Euphorbia hirta"Nano Bioscience, https://doi.org/10.33263/LIANBS141.001.
46. Nidhi Chaudhary, "A review on: The deciduous shrub "Punica granatum", European journal of biomedical and pharmaceutical sciences, 2016; 3(7); 2349-2388.
47. Singh Harmeet and Nidhi Chaudhary, "Evaluation of Lakshadi Guggul on experimentally induced global cerebral ischemia/reperfusion injury". World journal of Pharmacy and Pharmaceutical Sciences, 2016; 6(1); ISSN 2278-4357.
48. Nidhi Chaudhary and Harmeet Singh, "Evaluation of Punica Granatum Leaves Extract In Scopolamine Induced Learning And Memory Impairment In Mice". World journal of Pharmacy and Pharmaceutical Sciences, 6(6); 1677-1703.
49. Amandeep Singh, Pankaj Nainwal ,Deepak Nanda ,D.A. Jain, SOLUBILITY ENHENCEMENT OF PIOGLITAZONE WITH COMPLEXATION OF HYDROXYPROPYL-β-CYCLODEXTRIN, Digest Journal of Nanomaterials and Biostructures, Apr 2012 2(4): p.91-97.
50. Pankaj Nainwal Deepak Nanda, Amandeep Singh, D. A. Jain, QUANTITATIVE SPECTROPHOTOMETRIC DETERMINATION OF DOMPERIDONE TABLET FORMULATIONS USING IBUPROFEN SODIUM AS

HYDROTROPIC SOLUBILIZING AGENT, Digest Journal of Nanomaterials and Biostructures, 2012; 2(4): 751 – 753

51. Deepak Nanda, Pankaj Nainwal, Amandeep Singh, D.A.Jain, REVIEW ON MIXED-SOLVENCY CONCEPT: A NOVEL CONCEPT OF SOLUBILIZATION, Deepak Nanda et al. ,Journal of Pharmacy Research, 2012; 3(2): 411-413
52. Pankaj Nainwal, Amandeep Singh, Deepak Nanda, D.A.Jain, NEW QUANTITATIVE ESTIMATION OF ROSUVASTATIN BULK SAMPLE USING SODIUM BENZOATE AS HYDROTROPIC SOLUBILIZING AGENT, Journal of Pharmacy Research, 2012; 3(1): 6-8
53. Nainwal.P, Bhagla.A, Nanda.D, STUDY ON ANTIOXIDANT POTENTIAL AND WOUND HEALING ACTIVITY ON THE AQUEOUS EXTRACT OF FRUITS OF GARCINIA MANGOSTANA, IJPI's Journal of Pharmacognosy and Herbal Formulations, Volume-1
54. Pankaj Nainwal, Kapil Kalra, Deepak Nanda , Amandeep Singh, STUDY OF ANALGESIC AND ANTI-INFLAMMATORY ACTIVITIES OF THE ETHANOLIC EXTRACT ARIAL PARTS OF FUMARIA VAILLANTII LOISEL, Asian Journal of Pharmaceutical and Clinical Research, 2011; 4(1).
55. Amandeep Singh, Pankaj Nainwal, Deepak Nanda, D.A.Jain, SOLUBILITY ENHANCEMENT STUDY OF PIOGLITAZONE USING SOLID DISPERSION AS SOLUBILIZATION TECHNIQUE, International Journal of Science Innovations and Discoveries, Amandeep Singh et al., IJSID, 2011; 1(2): 95—100
56. Amandeep Singh, Pankaj Nainwal , Deepak Nanda, D. A. Jain, THE SOLUBILITY ENHANCEMENT STUDY OF PIOGLITAZONE USING DIFFERENT SOLUBLIZATION TECHNIQUIES, International Journal of Pharmacy & Pharmaceutical Sciences, 2012; 4(2).
57. Deepak Nanda, Pankaj Nainwal, Amandeep Singh, D.A.Jain, SOLUBILITY ENHANCEMENT STUDY OF DOMPERIDONE USING DIFFERENT SOLUBILIZATION TECHNIQUES, International Journal of Pharmacy and Pharmaceutical Sciences 2012; 2(3).
58. Pankaj Nainwal, Priyanka Sinha, Amandeep Singh, Deepak Nanda, D.A.Jain, A COMPARATIVE SOLUBILITY ENHANCEMENT STUDY OF ROSUVASTATIN USING SOLUBILIZATION TECHNIQUES, International Journal of Applied Biology & Pharmaceutical Technology, Oct - Dec -2011; 2(4).
59. Pankaj Nainwal , Deepak Nanda, Amandeep Singh, D. A. Jain, FORMULATION AND EVALUATION OF SOLID DISPERSION OF ROSUVASTATIN WITH VARIOUS CARRIERS ,Pharmacie Globale International Journal Of Comprehensive Pharmacy, Issn 0976-8157.
60. Pankaj Nainwal, Amandeep Singh1, Deepak Nanda, D.A.Jain, SOLUBILITY ENHANCEMENT OF AN ANTIHYPERLIPIDEMIC DRUG ROSUVASTATIN BY SOLID DISPERSION TECHNIQUE, International Journal of PharmTech Research IJPRIF ISSN : 0974-4304 , March-June 2012; 2: 3.
61. Kshitiz Agrawal, Pragati Bailwal, Amandeep Singh. Prem Saini, DEVELOPMENT OF QUALITY STANDARDS OF SUPRABHATAM CHURNA: A POLY HERBAL FORMULATION, International Journal of Pharmaceutical Research & Development,IJPRD, 2011; 4, June 2012.
62. Kapil Kalra, Amandeep Singh, Manisha Gaur, Ravindra P. Singh, and D. A. Jain, ENHANCEMENT OF BIOAVAILABLITY OF RIFAPENTINE BY SOLID DISPERSION TECHNIQUE , International Journal Of Pharmacy & Life Sciences, Kalra et al ., April, 2011; 2(4).

63. Pankaj nainwal ,Ranveer batsa, Amandeep singh, Deepak nanda, MEDICINAL PLANT STUDIES INFLUECED BY THE BIOTECHNOLOGICAL METHODS: A UPDATED REVIEW, International Journal of Pharma and Bio Sciences Apr-June-2011; 2(2).
64. Amandeep Singh, Sandhiya Pal, Prem Saini, IN- VITRO EVALUTION OF ANTI-INFLAMMATOTRY ACTIVITY OF TERMANALIA ARJUNA BARK EXTRACT, Journal of Innovative trends in Pharmaceutical Sciences,Vol-1(1): 9-12.
65. Amandeep Singh, Pramila Chauhan, Prem Saini, IN-VITRO ANTI-INFLAMMATORY EVALUTION OF HYDROALCOHALIC LEAVES EXTACT OF PINUS ROXBURGHII BY HRBC METHOD, International journal of Research in Pharmaceutical and Nano Sciences, 2013; 2(3): 268-271.
66. Amandeep Singh, Sumit Negi, Prem Saini, In Vitro Anti-Inflammatory Evaluation Of Leaves Using Hydroalcohalic Extract Of "Mangifera indica" International Journal of Pharmacy and Integrated Life Sciences, V1-(I7) PG (93-98).
67. Aman Deep Baghla, Kshitij Agarwal, Ramesh Verma and Deepak Nanda, Wound Healing Effect of the Aqueous Extract of the Leaves of Psidium guajava Linn., International Journal of chemicals and Life Sciences, 2013; 02 (03): 1104-1106.
68. Aman Deep Baghla, Kshitij Agarwal, Ramesh Verma and Deepak Nanda, WOUND HEALING EFFECT OF THE AQUEOUS EXTRACT OF THE LEAVES OF PSIDIUM GUAJAVA LINN., International Journal of chemicals and Life Sciences, 2013; 02(03): 1104-1106.
69. Bhupendra Kumar, Meenakshi Ghildiyal, Yogesh Tiwari , Deepika Chauhan, Amandeep Singh, IN-VITRO ANTI-INFLAMMATORY ACTIVITY OF GLYCINE MAX SEEDS ,Indo American Journal Of Pharmaceutical Sciences, 2018; 05(02): 868-871.
70. Piyali Dey, Jyoti Pandey, Bhupendra kumar, Amandeep Singh, IN VITRO ANTHELMINTIC ACTIVITY OF BARK EXTRACTS OF ARTOCARPUS HETEROPHYLLUS, International Journal of Pharmacy & Pharmaceutical Research, 2018; 03(11): 33-40.
71. Bhupendra Kumar, Yogesh Tiwari, Amandeep Singh, Vineet Kumar, IN VITRO ANTIUROLITHIC ACTIVITY OF FICUS PALMATA LEAVES, International Journal Of Pharmaceutical Technology And Biotechnology, 2019; 6(1): 01-09.
72. Md. Daneyal Khurshid, Vivek Shukla, Bhupendra Kumar and Amandeep A Review Paper on Medicinal Properties of Phyllanthus emblica , International Journal of Pharmacy and Biological Sciences, 2020; 10(3): 102-109.
73. Mr. Dwivedi Vishal, Mrs. Nisha A Bhatt, Dr. Amandeep Singh PREPARATION AND STANDARDIZATION OF NAVKARSHIKA CHURNA, World Journal Of Pharmacy And Pharmaceutical Sciences, 2020; 9(8).
74. Mitun Saha1, Mr. Bhupendra Kumar, Dr. Amandeep Singh Review Article on Various Phytochemicals and Different Medicinal Activities of Haritaki International Journal of Innovative Science and Research Technology, June 2020; 5(6).