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A REVIEW ARTICLE ON ANTISPASMODIC CHOCOLATE

Miss. Sabiha Z. Kazi[1], Miss. Seema A. Kengar [2], Prof. Vaibhav B. Bhagwat [3]

[1,2] Student, Department of Pharmaceutics, Vidya Niketan College of Pharmacy, Lakhewadi, Pune, Maharashtra, India.
[3] Assistant Professor, Department of Pharmaceutics, Vidya Niketan College of Pharmacy, Lakhewadi, Pune, Maharashtra, India.
[1]Department of Pharmaceutics
Vidya Niketan College of Pharmacy, Lakhewadi, MH, India.

Abstract: The present review states that a use of drug in the form of chocolate which is having an anti-spasmodic action that reduce the muscle cramp in especially ladies. The pleasant flavor and convenience of administration also help lessen the resistance that is often involved with taking medicine. this may boost the therapeutic impact of antispasmodic medicines by preserving more harmonious drug condition in the bloodstream. with the mixing of excipients with drug the stability of chocolate can be increases and that will also beneficial to the cramping one.

KEYWORDS - Antispasmodic activity, Antispasmodic chocolate , Muscle relaxants, Smooth muscle relaxation , Pain relief.

INTRODUCTION

The oral route of drug delivery is commonly used due to its convenience and effectiveness, but it has limitations, particularly with drugs that undergo significant first-pass metabolism in the liver.[1,2]In such cases, alternative routes, like mucosal administration, can be beneficial. This includes various mucosal sites such as the nasal, vaginal, rectal, and oral mucosa.[3]

An interesting and innovative approach is using chocolate as a delivery system for medications. Chocolate's anhydrous nature makes it resistant to microbial growth and the degradation of water-sensitive ingredients. Its ability to mask unpleasant tastes and provide a smooth texture makes it a promising vehicle for delivering active compounds, especially those that might otherwise be unpalatable or have undesirable textures.[4,5] Dark chocolate, historically used for its healing properties, has been consumed since at least 500 AD.[6,7] Over recent years, its consumption has increased due to the wider availability of commercially produced products.[8] Globally, chocolate consumption varies significantly, from 120 grams per person annually in China to about 12,000 grams per person in Ireland, with the USA averaging around 500 grams per person per year. Research on dark chocolate has mainly focused on its cardiovascular benefits, but there are also studies exploring its potential effects on other organs and health. Chocolate's versatility is largely due to its complex composition, which includes polyphenols, saturated fats, methylxanthines, and aliphatic alcohols (10).

It also contains phenylethylamine, a compound associated with feelings of happiness and pleasure, similar to those produced by the brain's chemicals. Additionally, chocolate can enhance the sensation of well-being by affecting blood pressure and blood sugar levels (11). Human taste is composed of five basic flavors: sweet, sour, bitter, salty, and umami, with sweetness being one of the most universally enjoyed (12).

Types of chocolate

1.Milk Chocolate - Made with Ecuadorian beans and medium-roasted WestAfrican beans for a clean, nutty, and faintly fruity flavor. Avoid Brazilian and Malaysian beans to maintain the milky notes.

2.Light Milk Chocolate - Features lightly roasted Java beans, resulting in a lighter colour and a mild, nutty flavour compared to standard milk chocolate.

3.Dark Chocolate - Known as "plain" or "black" chocolate, it has a high cocoa content (70%-99%), making it rich in antioxidants and lower in sugar. Typically eaten as is.[13]

4.Semisweet Chocolate - Used for its balanced cocoa character with nutty undertones. It often includes West African beans with additional floral and mildly spicy notes from Caracas and Trinidad beans.

5.Bittersweet Chocolate - Designed for sweet and flavorful cream centres, this chocolate is richer in cocoa liquor and less sweet than semisweet chocolate. It often includes added cocoa butter, vanilla, and sometimes lecithin.

6. Cookie Drop - Uses dominant West African beans complemented by Sanchez and Brazilian beans for a robust flavour, ideal for baked cookies.

7.Cocoa Powder - Comes in natural and Dutch-process varieties. Natural cocoa powder retains more flavonoids, while Dutch-process cocoa is less acidic but loses some flavonoids. Hershey now uses a special dark blend rather than pure Dutch- process cocoa.
Each type of chocolate serves different culinary purposes and flavour profiles, enhancing a variety of recipes and applications.[14]

ANTISPASMODIC ACTION:
Antispasmodic exertion is the capability of a substance to relieve muscle pressure and spasms in both the musculoskeletal system and the smooth muscles of holloworgans. Antispasmodics are also known as spasmolytics. They can be
pharmaceutical drugs or other agents and are generally either traditional or apothecary-only medicines. Antispasmodics work by relaxing smooth muscles, which helps relieve spasmodic pain. They are generally not sedating and act peripherally. The two main types of antispasmodics are :
1.Smooth Muscle Relaxants - These include drugs like alverine and mebeverine, which specifically target smooth muscle to reduce painand discomfort.
2. Anticholinergics - This order includes agents analogous to hyoscine. These work by inhibiting the action of acetylcholine, a neurotransmitter involved in musclecontraction, thereby helping to relieve spasms. These specifics are generally available by tradition or over-the-counter, depending on the specific drug and its nonsupervisory status. (15,16)

Antispasmodics are specifically designed to relax smooth muscles in internal organs, furnishing relief from various types of muscle spasms and cramps. These specifics are constantly used to palliate abdominal pain caused by muscle cramps in the digestive or urinary systems. - Reduce frequent urges to urinate or defecate. - Relieve cramps or spasms in the stomach, bowel, or bladder. - help symptoms analogous to nausea, puking, and stir sickness. - Treat peptic ulcers when combined with antacids or other treatments. They work primarily by blocking the muscarinic goods of acetylcholine on the gastrointestinal tract, which helps to relax smooth muscles, reduce spasms, break down intestinal motility, and lessen diarrhoea. (17)

ANTISPASMODIC CHOCOLATE":
Chocolate with antispasmodic parcels offers a unique and accessible delivery system for specifics. Unlike traditional tablets or capsules, it doesn't bear water for consumption, making it particularly suitable for children, the elderly, and cases that are constantly on the move. The affable taste and ease of administration also help reduce the resistance constantly associated with taking medicine, particularly in youthful cases. (18)
Research has indicated that chocolate can modify the drug release profile, potentially leading to a more controlled or sustained release of active ingredients. This could enhance the remedial effect of antispasmodic agents by maintaining further harmonious drug situations in the bloodstream. also, chocolate's high lipid content can ameliorate the bioavailability of deficiently water-answerable drugs by promoting better absorption in the gastrointestinal tract. Likewise, the appeal of chocolate as a delivery vehicle can significantly boost patient compliance, addressing one of the major challenges in habitual complaint operation. This is particularly applicable in conditions where regular medicine is essential, and any improvement in compliance can lead to better health issues. The combination of remedial benefits and increased acceptability makes chocolate an innovative approach to drug delivery, especially in populations that might struggle with conventional forms of medicine."(19)The drug(having antispasmodic action) acts as a direct antagonist at muscarinic acetylcholine receptors, which are set up in organs innervated by the cholinergic system, including the bladder. By blocking these receptors, the drug exerts an anticholinergic-parasympatholytic effect, meaning it inhibits the action of the parasympathetic nervous system. This leads to a reduction in the tone of smooth muscle in oxybutynin and tolterodine are samples of drugs that work through this medium. (20)

RESEARCH METHODOLOGY

MATERIALS
Chocolate base – Cocoa powder, Icing sugar , Antispasmodic drugs marketed from Lakhewadi ,Pune ,Maharashtra, India.

METHODOLOGY FOR CHOCOLATE MANUFACTURING PROCESS
The process of crafting chocolate involves several key stages that are essential to transforming raw cocoa into the final product. Here's a unique breakdown of these stages:
1.Blending: This initial step involves combining various ingredients, including cocoa beans, sugar, and milk powder, to achieve the desired flavour profile. Precise blending ensures that the chocolate's taste and texture are consistent.
2.Grinding: The blended mixture is then finely ground to break down the cocoa nibs and sugar into a smooth paste. This stage enhances the texture and consistency of the chocolate. (21).
3.Conching: In this critical phase, the chocolate paste is heated and continuously stirred in a concha (a type of machine), which refines its texture and develops its flavour. This process can last several hours, and the extent of conching impacts the final smoothness and taste of the chocolate. (22).
4.Tempering and Casting: The refined chocolate is carefully tempered—heated and cooled under controlled conditions—to stabilize the cocoa butter crystals. This ensures a glossy finish and smooth texture. The tempered chocolate is then cast into moulds to form various shapes.
***5.Moulding*:** After tempering, the chocolate is poured into moulds to take its final shape. Once it has cooled and set, the chocolate is demoulded and ready for packaging or further processing. (23).
Each of these stages plays a crucial role in determining the quality and characteristics of the finished chocolate. The process of crafting chocolate involves several key stages that are essential to transforming raw cocoa into the final product.

Method of Preparation for Chocolate Base

Preheat Oven: Set the oven to 50ºC to ensure a controlled environment for melting and mixing
Prepare Syrup: Combine sugar and water in a beaker and place it in the preheated oven for 4-5 minutes. This process creates a sugar syrup with a smooth consistency.
Melt Cocoa Butter: Place cocoa butter in a separate beaker and warm it in the oven for 1 minute. This ensures that the cocoa butter is fully melted and ready for mixing.
Combine Ingredients: Remove the sugar syrup from the oven and gradually incorporate cocoa powder into the syrup. Mix thoroughly to ensure a uniform blend of cocoa and syrup.
Mix Cocoa Butter: Gently fold the melted cocoa butter into the cocoa-sugar mixture, stirring continuously to integrate all components smoothly. Monitor the temperature closely to avoid overheating, which could affect the chocolate's texture.
Cool and Flavor: Allow the chocolate base mixture to cool until it reaches a semi- solid consistency. Once the desired texture is achieved, add any flavorings or additional ingredients as required. (24)-(25).

Formulation of Medicated Chocolate

***Preheat Oven*:** Set the oven to 50°C to ensure an optimal temperature formelting. (26).
***Melt Chocolate Base*:** Place the necessary amount of chocolate base into a heat- resistant container and melt it in the preheated oven until it achieves a smooth, liquid consistency. (28).
Incorporate Medication: Once the chocolate base is melted, carefully blend the specified quantity of the medicinal ingredient into the mixture. Stir thoroughly using a magnetic stirrer or manual stirring to ensure even distribution of the medication. (27).
***Add Preservatives*:** If required, incorporate the appropriate preservatives into the mixture. Ensure that they are well integrated to maintain the stability and shelf life of the medicated chocolate.

***Cool and Mould*:** Allow the mixture to cool until it reaches a semi-solid state. Pour the cooled mixture into moulds and refrigerate to solidify. (27).
This unique method ensures that the medicated chocolate is both effective and stable, with a uniform distribution of active ingredients.

Evaluation Parameters for Chocolate Base

1.Viscosity Measurement
Method Utilize a Brookfield Rotational Digital Viscometer to assess the viscosity of the chocolate base. For accurate results, set the spindle to rotate at 20 rpm. Preheat samples to 50°C before measuring to ensure consistency in viscosity readings.
Sensory Evaluation
Method: Conduct a sensory evaluation involving a panel of 10 trained volunteers. Evaluate the chocolate base based on three key attributes: taste, texture, and mouthfeel. Each attribute is rated on a scale from 1 to 10, where 1 indicates poor quality and 10 signifies excellent quality. This comprehensive assessment helps ensure the chocolate base meets desired sensory standards (29).

Evaluation Test for Medicated Chocolate

1.General Appearance
Visual Inspection: Assess the chocolate's color, which should be a rich dark brown. Look for uniformity in appearance, free from any discoloration or spots. (30)
A. Oduor: Evaluate the aroma, which should be a pleasant, pure chocolate scentwithout any burnt or smoky notes.
B. Taste: The flavor should be well-balanced, slightly sweet, and free from bitterness orexcessive sweetness.
C. Texture: The chocolate should have a smooth, glossy finish with a consistent texture.Any lumps, unevenness, or graininess should be noted. (28).
2.Moisture Content Determination
Method: Measure the moisture content using the digital Karl Fischer titration method.This precise technique calculates the percentage of water in the chocolate by titrating it with a reagent and is expressed as a percentage (%)
3.Blooming Test
A.Fat Bloom: Identify if a thin, white, or greyish layer has formed on the surface, which indicates fat bloom. This occurs when fat crystals re-crystallize or migrate to the surface, leading to a dull appearance and loss of gloss. Preventive measures include storing the chocolate at a consistent temperature to minimize this effect. (31)
B.Sugar Bloom: Check for an irregular, rough surface that results from sugar bloom. This happens when moisture from condensation (e.g., when removing chocolate from the refrigerator) dissolves the sugar. Upon drying, the sugar recrystallizes unevenly, creating an unattractive surface (32)

4.Dimensions
Measurement: The dimensions of the medicated chocolate are measuredusing a Vernier caliper. This ensures precise assessment of size and shape

5.Drug Content Determination
Method: The drug content within the medicated chocolate is quantified using a UV spectrophotometer (33). Measurements are taken at a wavelength of 260 nm against a blank reference to ensure accurate quantification. (34)

6.Drug-Excipient Compatibility Studies
Techniques: Compatibility between the drug and excipients is assessed using Differential Scanning Calorimetry (DSC) and Fourier Transform Infrared Spectroscopy (FTIR). Both the pure drug and the medicated chocolate formulation are evaluated to identify any potential interactions. (32)(33).

7.Melting Point Determination
Procedure: To determine the melting point, a glass beaker half-filled with water is placed on a tripod stand and heated with a burner. A porcelain dish with the medicated chocolate is positioned above the beaker. The temperature is monitored with a thermometer attached to the dish, recording the point at which the chocolate melts. (35).
Methodology: The disintegration test is performed using a disintegration tester set to 37±0.5°C with a rotation speed of 60 rpm. The test is conducted in a pH 6.8 buffer for 20 minutes, adhering to USP standards. (36).

9.In Vitro Drug Release
Procedure: Using a Type 1 USP dissolution apparatus (basket method), the medicated chocolate is subjected to dissolution testing in 900 ml of 0.1N HCl at 37±5°C and 50 rpm. At specified intervals (1, 2, 3, and up to 10 minutes), 10 ml samples are withdrawn, replaced with fresh medium, filtered, and analyzed using UV spectroscopy to determine the drug release profile. (37).

10.Stability Test
Definition: Stability testing assesses the capability of the medicated chocolate to maintain its physical, chemical, microbial, therapeutic, and toxicological properties throughout its shelf life. The formulation must retain at least 90% of its labelled potency to be considered stable. Stability testing aims to identify any changes that could impact the drug's efficacy or safety, such as

physical degradation, chemical changes, or microbial contamination. (37).

EFFECTS OF ANTISPASMODIC CHOCOLATE ON DIFFERENT TYPES OF HUMAN BODYSYSTEM

1.Effect on the cardiovascular system

Fig.1

Figure 1; Cocoa and dark chocolate improve cardiovascular health by enhancing bloodvessel function through nitric oxide-induced vasodilation, reducing inflammation, and providing antioxidant protection, all of which contribute to lower blood pressure and areduced risk of heart disease.[38]

***2. Effect on the central nervous system*:**

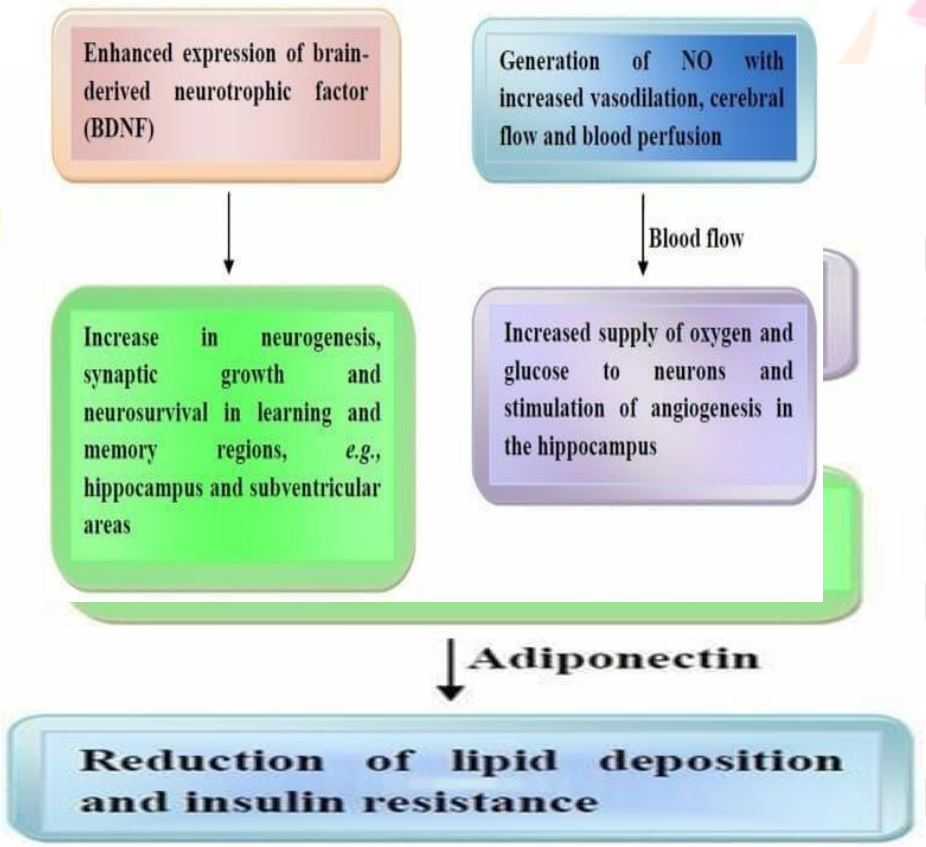

Fig.2

Figure 2: Cocoa flavanols enhance brain health by promoting the release of BDNF, which boosts neurogenesis and neuron survival, and by increasing nitric oxide production, whichimproves cerebral blood flow. (39)

3.Effect on the obesity

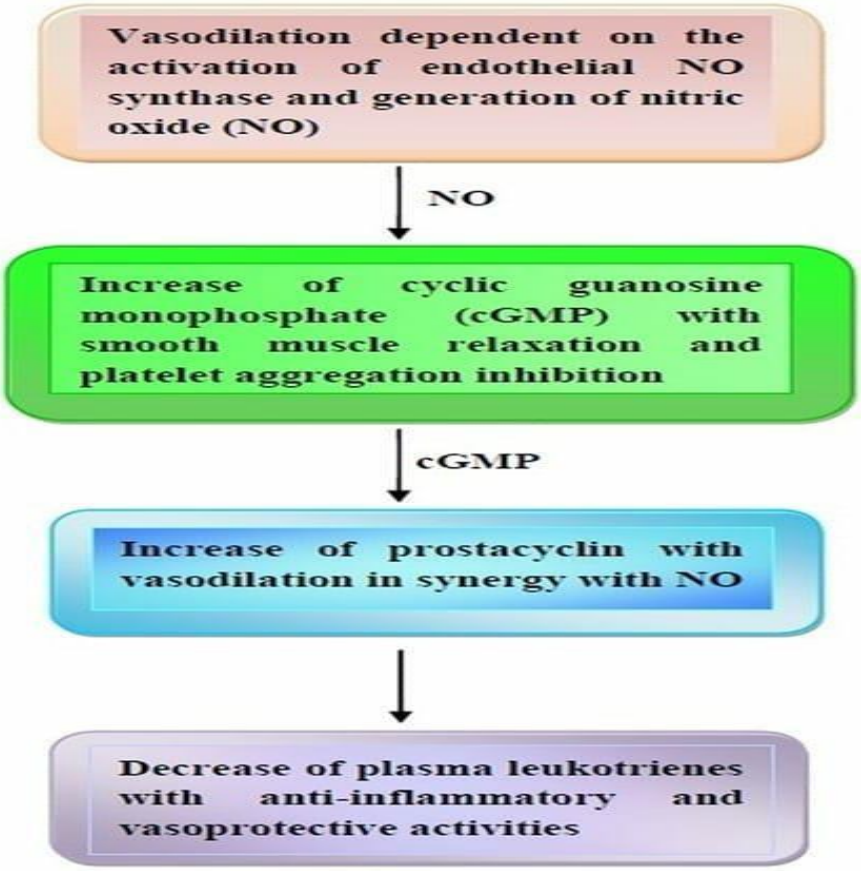

Fig.3

Figure 3: illustrates how cocoa flavanols combat obesity by increasing the expression of PPAR-γ and adiponectin, which reduce lipid deposition and improve insulin sensitivity, thus lowering insulin resistance. (40).

4.Effect on the immune system :

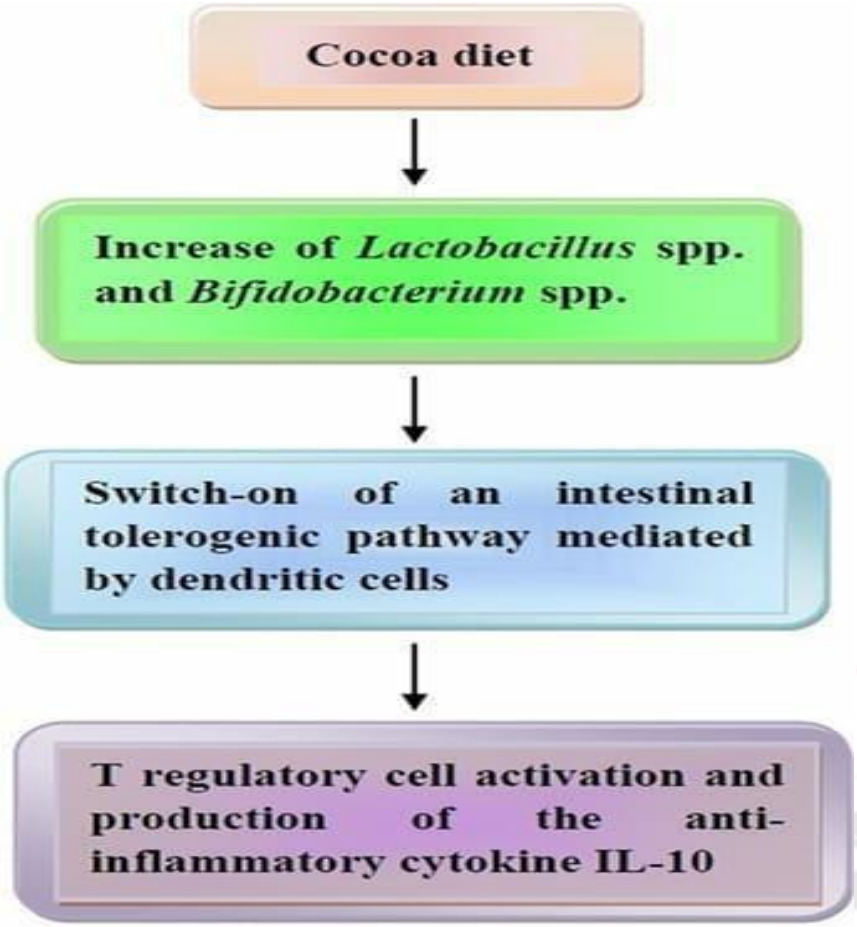

Fig.4

Figure 4 : shows that a cocoa-enriched diet alters the intestinal microbiota, promoting a tolerogenic pathway that results in the release of the anti- inflammatory cytokine IL-10. Further details of these effects are discussed in the accompanying text.[41]

APPLICATIONS:

Theobromine, a compound found in cocoa and chocolate, has several notable effects:

1.Diuretic Action: Theobromine promotes the removal of excess water from thebody through increased urination.
2.Magnesium Deficiency: In animal studies, cocoa's magnesium content hashelped prevent and correct magnesium deficiency. However, its effectiveness in treatingmagnesium deficiency in humans hasn't been thoroughly researched. [42]
3.Muscle Relaxation: Theobromine can induce relaxation in cardiac muscles.
4.Tooth Decay Prevention: Theobromine may help prevent tooth decay by actingagainst microorganisms in the mouth.[43]
5.Antidepressant Effect: Consuming chocolate can stimulate endorphin release,which may improve mood and alleviate symptoms of depression.[44]
6.Memory Improvement: Drinking hot chocolate has been associated with positive effects on brain function, potentially aiding in the prevention of degenerativediseases such as Alzheimer's.[45]
7.Cardiovascular Diseases: Due to its flavanol content, dark chocolate may help reduce the risk of cardiovascular diseases by promoting arterial health and preventingatherosclerosis.[46]
8.Hypoglycemic Action: Dark chocolate can support blood vessel health in diabetics, protect against type 2 diabetes, improve insulin resistance, and help maintain stable bloodsugar levels.[47]
9.Anticancer Action: Ongoing research suggests that dark chocolate may offer someprotection against cancer, though the exact mechanisms are still being studied.[48]
10.Antioxidant Action: Dark chocolate is a rich source of antioxidants, which helpprotect cells from damage, potentially slowing ageing and reducing cancer risk.[49]
11.Vitamins and Minerals: The vitamin and mineral content of dark chocolate, especially copper and potassium, supports overall health, including cardiovascularhealth.[49]
12.CNS Action: By improving blood flow to the brain and stimulating endorphinrelease, dark chocolate may aid in managing central nervous system disorders and improving mood.[47]
Chocolate, due to its water-resistant properties and inherent resistance to microbial growth and hydrolysis, serves as an exceptional medium for delivering active agents that are sensitive to moisture.[50]
In particular, the cocoa powder derived from cocoa beans, which is a key component of chocolate, contains anti-cariogenic agents.[51]

These agents play a crucial role in preventing tooth decay, primarily caused by the microorganism *Streptococcus mutans*.[51] This bacterium produces the glucosyltransferase enzymes (GTFB, GTFC, and GTFD), which adhere to teeth and initiate the decay process. Theobromine, a significant compound found in cocoa beans and their husks, exhibits two vital characteristics: anti-glucosyltransferase activity and antimicrobial activity. These properties not only protect against tooth decay but also contribute to the overall anti-cariogenic effect of chocolate.[52].

IV. RESULTS AND DISCUSSION

I. ACKNOWLEDGMENT

The attractiveness of chocolate as a delivery vehicle can greatly increase patient compliance, solving one of the primary obstacles in habitual complaint management. This is especially important in situations when frequent medication is required, and any improvement in compliance can lead to better health outcomes. Chocolate is a unique technique to medicine delivery due to its mix of beneficial properties and greater acceptance. The medicine [with antispasmodic activity] operates as a direct antagonist at muscarinic acetylcholine receptors, which are established in organs innervated by the cholinergic system inhibiting these receptors

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