

Development of Herbal Chocolate for Menstrual Cramps

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Abstract

People love chocolate more than any other food, but they hate medications. Therefore, the goal of this study was to develop the chocolate that contain herbal ingredients i.e. medicated chocolate to relieve menstrual cramps. Fenugreek seeds (*Trigonella foenum-graecum*), Shatavari (*Asparagus racemosus*), Ashwagandha (*Withania somnifera*), Cinnamon (*Cinnamomum zeylanicum*), Fennel (*Foeniculum vulgare*) are the herbs that help in treating menstrual cramps and Shatavari (*Asparagus racemosus*) is a natural remedy that possesses medicinal properties related to the female reproductive system, such as the ability to improve lactation, prevents miscarriage, removes the infertility and controls the menstruation. Physiochemical study was performed on herbal chocolate to determine the presence of protein, carbs, and glycoside, which signify the presence of various bimolecular components in chocolate. Overall appearance, pH, dimensions, stability, blooming test, hardness test, weight variation, and moisture content were all assessed for the prepared herbal chocolate.

Keywords: Dark compound, Herbs, Menstrual cramps, Dysmenorrhea, Chocolate formulation.

Introduction

In clinical practice and literature, the terms "dysmenorrhea" and "menstrual pain" are sometimes used interchangeably. They represent dull, throbbing pain that feels like cramps and usually comes from the lower abdomen, either before or during menstruation. According to some writers, there may be a kind of monthly discomfort known as "normal menstrual cramps" that is less severe than dysmenorrhea.^[1] Premenstrual pelvic pain, with or without systemic symptoms, is referred to as menstrual cramps sometimes known as menstrual pain syndrome or menalgia. Based on the cause, this might be categorized as primary or secondary. Primary dysmenorrhea is the diagnosis made when there are underlying organic issues. Organic illnesses that act as triggers are present in cases with secondary dysmenorrhea. The pain pattern linked with pathological disorders such as endometriosis, fibroids, adenomyosis, and pelvic inflammatory diseases is not consistent when it comes to secondary dysmenorrhea. A scientific explanation can help to explain dysmenorrhea; it is produced by disturbance in endometrial cells, which results in the release of prostaglandin, an F2alpha stimulant. Myometrium is stimulated by F2alpha to contract and constrict blood vessels. Prolonged stimulation protects the

myometrium from contracting, which further reduces blood supply and causes hypoxia in the uterine cells, which causes pain.^[2]

Menstrual diseases (MD) include amenorrhea, which is the absence of menstruation; oligomenorrhea, which is the infrequent occurrence of menstrual periods; menorrhagia, which is heavy bleeding, including prolonged menstrual periods or excessive bleeding during a normal-length period; menstrual cramps which is painful cramps during menstruation; and premenstrual syndrome (PMS), which is physical and psychological symptoms before menstruation. Between 30 and 40% of fertile females have been reported to have PMS. Additionally, a prevalence of 14% to 25% has been noted in women who have irregular menstrual periods. This variability includes cycles that are abnormally long or short, flow abnormally in terms of weight or lightness, or are accompanied by additional problems such as cramping in the abdomen.^[3]

For women, menstruation is a sign of balance and a healthy body that develops after puberty. A female adolescent's menarche, which generally starts at age 11, concludes with menopause, which occurs between the late forties and mid-fifties. Women who suffer from cramps, a pain that occurs during the menstrual cycle, may also have other symptoms such as general discomfort, headaches, backaches, nausea, exhaustion, and emotional and psychological repercussions. The Greek terms dys which means unpleasant, uncomfortable, or abnormal, meno which means month and rhea which means flow are the roots of the phrase dysmenorrhoea. Usually lasting 48–72 hours after menstruation, menstrual cramps affects half of the young women. Early menarche age, smoking, low body mass index, blood flow duration, familial history, null parity, and stress are all associated with menstrual cramps. Numerous studies have revealed regional differences in the prevalence of dysmenorrhea; among adolescents, the condition was found to be quite prevalent (between 50% and 70%) A global meta-analysis and systematic review covering numerous studies revealed a high prevalence rate of menstrual cramps (71%) among women. Further more research indicates that menstrual cramps impacts everyday activities and quality of life throughout the monthly menstrual cycle in addition to causing physical and emotional suffering. In a cross-sectional study conducted in Sweden with 600 women aged 19 years old, it was found that more than 50 of the women missed work or school because of menstrual cramps. According to reports, between 13 and 51 % of women missed school or university, which had a detrimental effect on their employment or studies.

A quarter or so of women with menstrual cramps experienced severe symptoms, which negatively impacted their well-being and quality of life. The degree of menstrual cramps its interference with everyday activities, and the quality of sleep are all directly correlated. Compared to women with mild menstrual cramps women with moderate to severe menstrual cramps had lower sleep efficiency and lower quality sleep. Moreover, menstrual cramps modifies women's emotions and social interactions, reduces hunger, the sense of regret for being a woman, and the belief that they won't become parents in the future.^[4]

Herbal medicine has become a popular treatment for primary menstrual cramps in recent years. According to conventional Chinese medicine, drinking cold beverages, being outside in the rain, or wading through the uterus can induce cold moisture to stagnate in the uterine collaterals, which can lead to menstrual cramps. When a cold snap strikes, the blood coagulates, causing the uterine collaterals to become unsmooth and stagnant, which in turn causes pain. Therefore, the treatment of menstrual cramps should be based on the principles of warming meridians, distributing cold, and eliminating moisture. Natural items that are frequently utilized dissipate Fenugreek seeds (*Trigonella foenum-graecum*),

Shatawari (*Asparagus racemosus*), Ashwagandha (*Withania somnifera*), Dark compounds, Fennel (*Foeniculum vulgare*), Cinnamon (*Cinnamomum zeylanicum*) dissipate cold, eliminate moisture, and embrace all warm meridians.^[5]

Ideal Features of chocolate for menstrual cramps

1. It need to be tastefully done.
2. It need to be of excellent quality.
3. Its texture need to be completely smooth.
4. It should be appear original.
5. It should melt in your hand or mouth.
6. It should have a pleasing colour.
7. It need to be appealing.
8. It must be inexpensive.
9. It should be simple to find.
10. It must be cost effective.

Review of literature

Azizah R. et al. 2023.

Approximately 55% of females suffer dysmenorrhea. Dark chocolate is one food that can reduce the pain associated with menstruation. It is also known that other herbal substances such red ginger, turmeric, moringa, sambiloto, and honey might lessen pain. Nevertheless, studies on the pairing of dark chocolate with herbal components has not been studied. Consequently, the purpose of this study is to ascertain whether combining dark chocolate with herbs will lessen menstruation pain. Thirty respondents were used for this test, and they were split into three groups: dark chocolate (C), positive control group (K), and dark chocolate plus herbs (C+H). A 250 mL beverage was made by combining dark chocolate with herbal ingredients such as red ginger, turmeric, moringa, sambiloto extract, and honey. It is a quantitative research project.^[6]

Verma A. et al. 2019.

A intense, painful, cramp experience in the lower abdomen that is often followed by additional symptoms, such as sweating, nausea, migraines, etc., all occurring soon before or during the periods is known as premenstrual pain (PMS), dysmenorrhea, or painful menstruation. Many medications, most notably non-steroidal anti-inflammatory medicines (NSAIDS), are used to relieve pain at this time. The goal of this study is to assess the claims made for dark chocolate as an NSAIDS substitute. Ninety nine selected students were split up into three groups and given 120 grammes of dark, milk, or no chocolate every day depending on their group. Pain was measured using the Numeric Rate Scale (NRS) both before and after the intervention. Following the use of, premenstrual and menstrual pain were greatly reduced.^[7]

Maharani S. et al. 2017.

The study aimed to investigate the effect of dark chocolate on menstrual pain in late adolescents. This was a true experiment study with randomised pretest-posttest with control group design. It was carried out from September to November 2016 at the Bhakti Husada Boarding School of Poltekkes Kemenkes Semarang. The numeric rate scale (NRS) was employed to determine pain. Independent t-test and Mann-Whitney U-test were also used. The effect of the intervention was investigated using the Mann-Whitney

and Independent T-test. Menstrual discomfort differed significantly ($p < 0.001$) before and after treatment. With a p-value of less than 0.001, the treatment group's mean period discomfort (2.76) was less than that of the control group (5.36). For late adolescents, dark chocolate has been shown to dramatically lessen menstruation discomfort.^[8]

Satriawati A. et al. 2020.

Adolescent reproductive health is still a problem that requires attention. One of the many women who experience discomfort at the onset of menstruation is dysmenorrhea. This study aims to determine the effect of a combination of warm compress and chocolate to decrease menstruation pain (dysmenorrhea) on raja in SMP Negeri 1 Bangkalan. The population in this study consisted of female students of SMP Negeri 1 Bangkalan who had dysmenorrhea. The sample technique used for this research was simple random sampling with an inclusion and exclusion criteria of 54 respondents divided into two groups, each with 27 respondents. Data analysis was done using the chisquare test and logistic regression. The combination of warm and chocolate compresses was found to have an impact on the reduction of menstrual discomfort (p -value = 0.050). Additionally, additional factors influence the IMT (p -value 0.032) decrease in menstruation discomfort. If teenage girls continue to have pain during their periods, it is advised that they get their reproductive organs checked.^[9]

Sa'idah1 S. et al. 2023.

Due to its numerous health benefits, dark chocolate can be used as a substitute to help manage pain throughout the menstrual cycle. The purpose of this study was to ascertain whether providing dark chocolate to female staff members at Cabangbungin General Hospital in Bekasi Regency in 2023 will alleviate their menstrual pain associated with dysmenorrhea. This study involved 32 research individuals and was experimental in nature. SPSS version 25 was used for both univariate and bivariate data analysis. The paired sample t-test statistical test findings showed a p value of 0.000 and an α value of 0.05 ($p < \alpha$), suggesting that feeding dark chocolate has an effect on lowering menstrual discomfort associated with dysmenorrhea. In 2023, giving dark chocolate to female staff members at Cabangbungin General Hospital in the Bekasi Regency had the impact of lowering dysmenorrhea monthly discomfort.^[10]

Nuha K. et al. 2023.

A considerable percentage of women worldwide suffer from dysmenorrhea, or the pain that comes with the menstrual cycle, which frequently results in lower productivity. There are several pharmaceutical and non-pharmacological pain management treatments available; however, there is still a dearth of knowledge regarding their efficacy, especially with regard to green coconut water, dark chocolate, and Ibuprofen.

The purpose of this study was to compare how well Ibuprofen, dark chocolate bars, and green coconut water reduced the severity of primary dysmenorrhea. In this study, 45 individuals were randomly assigned to receive 400 mg of Ibuprofen, 35 g of 70% dark chocolate, or 330 mL of green coconut water in a randomised controlled experiment with a quantitative design. The individuals were given the interventions on the first day of menstruation, which is when dysmenorrhea symptoms usually appear. This study assessed each treatment's immediate effects using a single-dose methodology. Within fifteen minutes, the individuals were to consume the provided interventional substance. Prior to the intervention, the degree of pain was assessed using a Numeric Rating Scale and two hours after the participants completed using the interventional substance. The multivariate Kruskal-Wallis test showed that there was a significant difference ($p < 0.05$) in the three therapies' effectiveness. Ibuprofen was the

most successful strategy, according to the study, when compared to the other therapies. These results underline the effectiveness of Ibuprofen and advance our knowledge of primary dysmenorrhea treatment choices.^[11]

Singh K. et al. 2022.

Since chocolate is a favourite food among people and medicine is a hated substance, the goal of this study was to manufacture medicated chocolate, or chocolate that contains drugs, to prevent various disorders. *Withania somnifera*, also known as ashwagandha, is a herbal drug with several medicinal properties, including anti-stress, anti-inflammatory, and nervous system effects, and *Asparagus racemosus*, also known as shatavari, is a herbal drug with several medicinal properties, including preventing miscarriage, increasing lactation, removing infertility, and regulating the menstrual cycle. As a result, powdered ashwagandha and shatavari must be used to create chocolate that has the desired pharmacological effects. Finally, prepared medicated chocolate is assessed for general application.^[12]

Aim – Formulation and evaluation of herbal dark chocolate for menstrual cramps.

Objective

1. The main objective of this research work was to formulate the herbal chocolate which is used in menstrual cramps and does not cause side effects or adverse reaction.
2. To study safety and efficacy of prepared herbal chocolate.

Phytochemistry of herbs used in formulation

1) Shatavari



Figure No 1: Shatavari

- Biological Source – Shatavari is derived from dried tuberous roots of *Asparagus racemosus* Wild.
- Family – Liliaceae.
- Medicinal Uses and Significance-
 1. It works well for premenstrual syndrome and menstrual cramps.
 2. It is regarded as a female tonic in Ayurveda.
 3. Additionally, it is used to treat night blindness, renal issues, throat complaints, anticancer, anti-inflammatory, blood purifier, galactagogue, astringent, antidiarrhoeal, antidyseritic, laxative, and antitubercular disorders.^[13]

2) Ashwagandha



Figure No 2: Ashwagandha

- Biological Source – Ashwagandha is obtained from the dried roots and stem bases of *Withania somnifera dunal*.
- Family - Solanaceae.
- Medicinal Uses and Significance -
 1. Prolactin is a hormone required for breastfeeding that is produced in greater quantities by shatavari.
 2. Ashwagandha used has been try dealing with disorders like polycystic ovarian syndrome and infertility that are caused by in an imbalance hormones.
 3. Decrease menopausal symptoms and menstrual cramps. ^[14]

3) Fennel



Figure No 3: Fennel

- Biological Source – Fennel is obtained from the dried ripe fruits of *Foeniculum vulgare*.
- Family – *Foeniculum vulgare L.*
- Medicinal Uses and Significance –
 1. Fennel used as a natural remedy for primary dysmenorrhea that is both safe and effective.
 2. Fennel also act as antimicrobial properties, antispasmodic, Stimulant, carminative and expectorant, Anticarcinogenic properties, Antioxidant activity, Muscle relaxant, Nausea and stress relaxer, Antiparasitic, Nausea and stress relaxer. ^[15]

4) Fenugreek seeds



Figure No. 4: Fenugreek seeds

- Biological Source – It consist of seeds and leaves of *Trigonella foenum-graecum*.
- Family- Fabaceae
- Medicinal Uses and Significance-
 1. It has traditional and functional uses in food preparation, nutraceuticals, and physiological applications.
 2. Fenugreek was used as a tonic for the metabolism and to help with labor and menstrual cramps in ancient rome.
 3. Patent medication for symptoms related to periods and menstrual cramps.
 4. Fenugreek seeds reduce insulin resistance and enhance glucose regulation.^[16]

5) Cinnamon



Figure No 5: Cinnamon

- Biological Source-It consist of dried inner bark of the shoots of coppiced trees of *cinamomum zeylanicum*.
- Family-Lauraceae.
- Medicinal Uses and Significance-
 1. Cooking uses the bark of the cinnamon plant as a flavoring and condiment.

2. In action, it has stimulant, astringent, carminative, and antibacterial properties. antifungal, antibacterial properties .
3. It is used to treat diarrhea, gas, and gastrointestinal (GI) distress. Moreover, it is utilized to treat bacterial and parasitic worm infections, menstrual cramps, and appetite stimulation.
4. The flu and the common cold (influenza). Cinnamon bark oil improves the appetite, eases indigestion, and lessens spasms. Moreover, it decreases blood sugar levels and improves blood flow.^[17]

Material and Methods

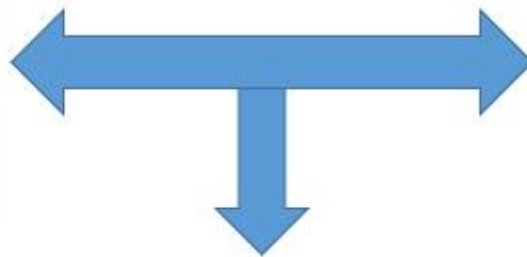
Material

Shatavari , Ashwagandha, Fennel, Fenugreek seeds, Cinnamon, Icing sugar, Lecithin, Cocoa butter ,Cocoa beans, Sodium carbonate, Chocolate extract.

Preparation of dark chocolate



Cocoa bean



Icing sugar



Mixing

(Cocoa beans and icing sugar for 2 minutes)



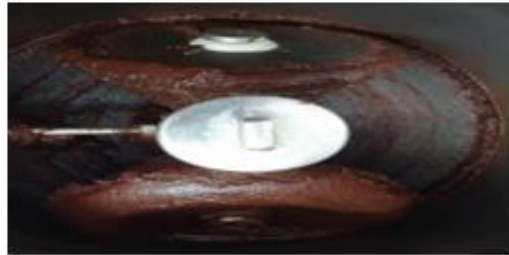
Prior to refining

(Using two roller refining to partially reduce the particle size for 2 hour)



Prior to refining

(Using five roller refining to partially reduce the particle size for 3 hour)

**Conching**

(Use of double overthrow conche to obtain perfect textural, sensory, and rheological qualities for 12 hours.) Also addition of lecithin, cocoa butter, sodium carbonate, chocolate extract.

**Tempering**

(Cocoa butter crystallization in its most stable form for 1 hour.)



Kept in freeze to set overnight for cooling.





Demoulding



Packing^[18]

Preparation of herbal chocolate^[19]

SR.NO	FORMULA	QUANTITY TAKEN
1)	Shatavari powder	0.5 gm
2)	Ashwagandha powder	0.5 gm
3)	Funnel powder	0.5 gm
4)	Fenugreek seed powder	0.5 gm
5)	Cinnamon powder	0.2 gm
6)	Dark compound	30 gm

All the ingredients were weight accurately



Melt the dark chocolate using double boiling method



Addition of all herbal ingredients into the melted chocolate



Addition of chocolate essence into the melted chocolate as flavouring agent



Filling of the chocolate mixture in a chocolate mould



Kept in refrigerator to set overnight



Packaging.

Evaluation test

1. Organoleptic Property

- Colour
- Odour
- Taste

2. Preliminary Phytochemical Screening

- Test for carbohydrate
- Test for protein
- Test for saponins glycoside

3. pH

- Blooming Test
- Fat blooming
- Sugar blooming

4. Hardness

5. Stability

6. Weight variation

7. Dimensions

1) Organoleptic Properties:

The overall elegance, visual identity, and general appearance of chocolate formulation are important.

- To ensure customer acceptability;
- To maintain uniformity from lot to lot;
- To oversee trouble-free manufacturing.

A variety of characteristics, including colour, taste, mouthfeel, surface texture, and odour, are measured in order to regulate the overall appearance of chocolate.

2) Initial Phytochemical Screening:

This screening was done to see if any organic chemical components were included in the creation of chocolate. The following organic chemical components carbohydrate, protein, amino acid, fats and oils, steroids, volatile oil, glycoside, flavonoids, alkaloids, tannins and phenolic substance, vitamins, gum and mucilage were examined to determine if they were present or absent in the formulations stated above.

2.1) Carbohydrate Test (Molichs Test/General Test):

Take two to three milliliters of chocolate formulation, add a few drops of alcohol-based alpha-naphthol solutions, shake, and add conc. The violet ring at the intersection of two liquids, which is a form of sulfuric acid from the test tube's side, indicates the existence of carbohydrates.

2.2) Protein Assay (Biuret Test/ General Test):

Take 3 milliliters of chocolate formulation, add a few drops of 1% copper sulfate solution, and dilute it with 4% NaOH. The violet color indicates the presence of protein.

2.3) Test for Saponins Glycoside (Froth Formation):

Add 2 milliliters of chocolate formulation to a test tube, fill it with water, and shake vigorously. and stable foam formations signify the presence of glycoside saponins.

3) pH:

A digital pH meter fitted with a glass electrode was used to measure the pH of the mixture that was created after dissolving 2 grams of prepared chocolate in 100 milliliters of phosphate buffer solution.

4) The blooming test:

4.1) Fat Blooms:

A soft white coating and a loss of gloss are caused by a thin layer of fat crystals foaming on the top of chocolate formulation, giving the final product an unappealing appearance. The migration of a filling fat to the chocolate layer or the recrystallization of fats are the two main causes of fat bloom, and storing at a steady temperature will postpone its onset.

4.2) Sugar Bloom:

This is the coarse, asymmetrical layer that sits on the chocolate mixture. Condensation is what happens when chocolate is removed from the refrigerator and results in sugar bloom. The chocolate's sugar will melt due to this moisture. The sugar then recrystallizes creating an uneven, rough crystal on the surface when the water eventually evaporates. This makes chocolate appear unappealing. Every sample underwent treatment cycles that included: (1) 11 hours at 30 °C, (2) 1 hour of temperature shifting, (3) 11 hours at 18 °C, and (4) 1 hour of temperature shifting. After being kept at 18 °C for 11 hours, a test chocolate formulation was used to determine whether or not blooming had occurred.

5) Hardness:

A particular degree of hardness is required for a chocolate bar to break across its perimeter. The hardness of chocolate is a good indicator of its strength. The hardness was measured with a Monsanto Hardness tester. The values were expressed in kg/cm².

6) Stability:

In a particular formulation within a particular container, medicinal items are said to be stable if they are able to retain their physical, chemical, microbiological, therapeutic, and toxicological requirements. Stated differently, a drug's stability refers to its ability to resist deterioration. 90% of the indicated potency is generally considered as the lowest allowable potency level. Drug degradation can occur in a number of ways as a result of modifications to its chemical, physical, and microbiological characteristics. The changes can make the product less effective as a medication or more hazardous.^[20]

7) Weight variation:

Weighing was done on six chocolate recipes both individually and collectively. The average weight was determined by weighing all of the chocolate. The individual weights were compared to the average weight. The percentage difference of the weight change must not exceed the permitted limits. The percent deviation was calculated using the following formula.^[21]

$$\% \text{Deviation} = \frac{\text{Individual weight} - \text{Average weight}}{\text{Average weight}} \times 100$$

8) Dimensions:

It was measured by Vernier’s callipers.^[22]

Result and Discussion

1.1) Organoleptic properties (Evaluation of taste, texture, and mouthfeel)

Table displays the properties of prepared chocolate formulation in terms of taste, texture, and mouthfeel.

Parameter	Observation
Colour	Brown
Odour	Chocolate
Taste	Slightly bitter
Mouth feel	Smooth and Pleasant
Appearance	Glossy, even shine, no streaks, dots, crack

Table 1.1: Result of organoleptic properties

1.2) Initial phytochemical screening:

Initial phytochemical screening of the chocolate method, as displayed in the table below.

Phytoconstituent	Bacoside extract	Scopoletin extract	Chocolate formulation
Carbohydrate	Positive	Positive	Positive
Protein	Positive	Positive	Positive
Glycoside	Positive	Positive	Positive

Table 1.2: Result of preliminary phytochemical screening.

1.3) pH:

Using a pH meter, the PH of the chocolate formulation was determined to be pH =5.87



Figure No. 6: pH determination

1.4) Blooming test :

Test	Result
Fat bloom	No
Sugar bloom	No

Table 1.3: Result of blooming test

1.5) Hardness:

The Monsanto Hardness Tester was used to determine the hardness of chocolate formation. The observed results are shown in table no.1.4.

Initial reading	After breakage of chocolate	Hardness present in the chocolate
0	2	2kg/cm ²

Table 1.4: Result of hardness test

1.6) Stability test:

The organoleptic characteristics of the formulation were examined at the conclusion of the month. The observed results are listed in the table.

Parameter	Storage condition	At the time of preparation	After the one month
Colour	28 ⁰ C(Regulated)	Brown	Nothing modified
Odour		Delicious chocolate	
Taste		Slight bitter	
Mouth feel	25 ⁰ C	Smooth and pleasant	Nothing modified
Appearance		Even, shine, no streaks, dot, cracks	

Table 1.5 Result of stability test

1.7) Weight variation determination:

$$\begin{aligned} \text{Average weight of 5 formulations calculated to be} &= \frac{W_1+W_2+W_3+W_4+W_5}{5} \\ &= \frac{10.10+10.22+10.34+9.97+10.11}{5} \\ &= 10.15 \end{aligned}$$

1.8) Dimensions:

It was measured by Vernier’s callipers.

Parameters	Result
Height	1.5 ± 0.2
Diameter	2.3 ± 0.1

Table 1.6 Result of dimension study



Figure No. 7: The actual photograph of formulated herbal chocolate

Conclusion

Based on the study's result, dark chocolate combined with herbal substances includes Fennel, Ashwagandha, Cinnamon, Shatavari and Fenugreek seeds may have the ability to reduce menstruation discomfort, so it could be as alternative therapy for menstrual cramps. Physiochemical studies revealed the presence of protein, carbs, and glycoside in the chocolate. The chocolate was assessed for appearance, stability, and moisture content. Based on the above discussion, we assumed that the chocolates provide a silky, smooth surface to the details and are excellent at masking the unpleasant taste associated with the drugs and treatments that are used in the dosage range are safe to ingest and do not carry a risk of side effects.

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