



Research Article

BRIDGING TRADITIONAL WISDOM AND SCIENTIFIC ANALYSIS: FORMULATING AN AYURVEDIC NUTRITIONAL SNACK FOR ANEMIA PREVENTION AND NUTRITIONAL GROWTH

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ABSTRACT

Anemia and nutritional deficiencies continue to be significant health challenges globally, affecting individuals of all ages and socio-economic backgrounds. In this study, we aimed to bridge traditional Ayurvedic wisdom with scientific analysis to develop an Ayurvedic nutritional snack for the prevention of anemia and promotion of nutritional growth. Drawing inspiration from the Ayurvedic literatures, we selected key ingredients such as ground nut, jaggery, wheat flour, and a blend of medicinal herbs and spices. Through meticulous formulation and quality control measures, we created a unique snack that combines the principles of Ayurveda with modern nutritional insights. Laboratory analysis confirmed the snack's rich nutritional profile, including essential nutrients such as iron, and calcium. Furthermore, a comparative analysis demonstrated that consuming 25 grams of the snack contributed to the fulfillment of various recommended daily allowances.

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INTRODUCTION

Ayurveda, which translates to "the science of life" in Sanskrit, is an ancient holistic system of medicine that originated in India over 5,000 years ago. It offers a comprehensive approach to healthcare, focusing on the balance and harmony of mind, body, and spirit to achieve optimal well-being. Ayurvedic principles emphasize the prevention of diseases and the promotion of health through a personalized approach tailored to an individual's unique constitution. Ayurveda views health as a state of equilibrium between the three fundamental energies or doshas: Vata (air and space), Pitta (fire and water), and Kapha (earth and water). According to Ayurvedic philosophy, any imbalance in these doshas can lead to illness. Therefore, the primary goal of Ayurveda is to restore the balance of the doshas through various holistic interventions, including diet, lifestyle modifications, herbal remedies, meditation, and therapies¹. The Ayurvedic approach to healthcare recognizes that nutrition plays a vital role in maintaining overall health and preventing diseases. Ayurvedic texts extensively discuss the importance of a balanced diet in nourishing the body and supporting its natural healing processes. Traditional Ayurvedic nutrition focuses on incorporating six tastes (sweet, sour, salty, bitter, pungent, and astringent) into meals to ensure the consumption of a wide range of nutrients².

Nutrition plays a crucial role in maintaining overall health and well-being. Adequate nutrient intake is essential for the proper

functioning of the body, supporting growth, development, and optimal physiological processes. In particular, nutrition plays a vital role in preventing anemia, a condition characterized by a decrease in the number of red blood cells or a decrease in the amount of hemoglobin in the blood. Anemia can result from various factors, including nutritional deficiencies, such as iron, folate, and vitamin B12. Here is an overview of their roles:

Iron: Iron is essential for the production of hemoglobin, a protein in red blood cells that carries oxygen throughout the body. Iron deficiency is one of the leading causes of anemia, as it results in decreased hemoglobin production. Consuming adequate iron-rich foods or supplements helps prevent and treat iron deficiency anemia.

Folate (Vitamin B9): Folate is necessary for red blood cell production and the synthesis of DNA. Folate deficiency can lead to a type of anemia called megaloblastic anemia, characterized by abnormally large red blood cells. Consuming foods rich in folate or taking folate supplements can help address folate deficiency anemia.

Vitamin B12: Vitamin B12 is involved in DNA synthesis, red blood cell production, and maintaining the health of nerve cells. Deficiency in vitamin B12 can lead to megaloblastic anemia. It is primarily found in animal-based foods, and individuals following a strict vegetarian or vegan diet may be at a higher risk of deficiency. Vitamin B12 supplementation or consuming fortified foods is necessary for addressing vitamin B12 deficiency anemia.

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Vitamin C: Vitamin C aids in the absorption of dietary iron from plant-based sources and helps convert iron into a more absorbable form. It plays a supportive role in addressing iron deficiency anemia by enhancing iron absorption. Including vitamin C-rich foods in meals or taking vitamin C supplements can assist in optimizing iron absorption.

Other Micronutrients: Several other micronutrients, such as vitamin A, zinc, copper, and manganese, are involved in the production and function of red blood cells. Deficiencies in these micronutrients can contribute to anemia or impair the body's ability to address anemia effectively. Ensuring an adequate intake of these micronutrients through a balanced diet or supplementation can help support healthy blood cell production and address anemia.

Globally, anemia is a significant public health concern, affecting people of all ages, genders, and socioeconomic backgrounds. According to the World Health Organization (WHO), an estimated 1.62 billion people worldwide, accounting for nearly a quarter of the global population, were affected by anemia in 2019³. The highest prevalence of anemia was observed in preschool-age children (47.4%), followed by non-pregnant women of reproductive age (25.4%). In India, anemia is a major health issue, particularly among women and children. The National Family Health Survey (NFHS) conducted in 2019-2020 revealed that around 40% of children under the age of five and 50% of women aged 15-49 in India were anemic. The prevalence of anemia is especially high among pregnant women, with approximately 53% being affected by this condition⁴. These high prevalence rates of anemia emphasize the critical need for nutritional interventions to prevent and combat this condition. Iron deficiency is one of the leading causes of anemia worldwide, including India. Addressing nutritional deficiencies through appropriate dietary strategies and nutritional supplementation programs can significantly contribute to reducing the burden of anemia and improving overall health outcomes.

Chikki is a traditional Indian sweet snack that has been enjoyed for centuries. It is made by combining jaggery (a natural sweetener) and various types of nuts, seeds, or grains. The mixture is cooked until it solidifies and then cooled and cut into small, rectangular-shaped pieces. Chikki is known for its crunchy texture and rich, caramel-like flavor. One of the key ingredients in Chikki is jaggery. Jaggery, derived from sugarcane, is a natural sweetener that is unrefined and retains its natural minerals and nutrients. It is a healthier alternative to refined sugar and provides a range of essential minerals like iron, calcium, and potassium. Another important component of Chikki is the nuts, seeds, or grains used. Popular choices include peanuts, sesame seeds, cashews, almonds, and puffed rice. These ingredients not only add a delightful crunch to the snack but also contribute various health benefits. Nuts and seeds are rich in healthy fats, protein, and fiber, while grains like puffed rice provide carbohydrates for energy. The process of making Chikki involves heating the jaggery in a pan until it melts and reaches a specific temperature. Then, the nuts, seeds, or grains are added to the molten jaggery and mixed thoroughly. The mixture is then spread onto a greased surface and allowed to cool and harden. Once it has solidified, it is cut into individual pieces. Chikki is not only a delicious snack but also offers several nutritional benefits. It provides a good amount of energy due to the presence of carbohydrates and

healthy fats from nuts or seeds. The inclusion of jaggery adds essential minerals like iron and calcium to the snack, making it a healthier alternative to other sugary treats. Additionally, the nuts and seeds in Chikki are a great source of protein, fiber, and various micronutrients, depending on the ingredients used. Chikki is enjoyed by people of all ages and is often consumed as a snack or dessert. It is commonly made during festivals and special occasions in India, as it is considered auspicious and symbolizes good luck and prosperity.

In the quest for innovative ways to incorporate Ayurvedic principles into modern nutritional practices, the development of an Ayurvedic nutritional snack holds immense promise. By combining traditional Ayurvedic ingredients with a modern twist, this snack aims to prevent anemia and support nutritional growth.

MATERIALS & METHOD

This unique formulation includes Ground nut, Jaggery, Ghee, Wheat flour, Guduchi churna, Yasti churna, Amalaki churna, Trikatu churna, Lauha bhasma, and Ela. Each ingredient is carefully selected to offer a synergistic blend of nutrients and therapeutic properties along with palatability.

Materials: For a 1000 gms batch of the Ayurvedic nutritional snack, the following ingredients and quantities are utilized:

No.	Ingredients	Quantity in grams
1	Ground nut	400
2	Jaggery	400
3	Ghee	60
4	Amalaki churna	40
5	Yasti or Yastimadhu churna	30
6	Wheat flour	20
7	Guduchi churna	20
8	Trikatu churna	20
9	Lauha Bhasma	4
10	Ela	6
	Total	1000 grams

METHODOLOGY

The preparation method of the Ayurvedic nutritional snack involved several steps. First, the Ground nuts were roasted and dehusked. Then, the wheat flour was dry roasted and set aside. In a separate process, jaggery was heated with water to create a paaka, and a small amount of ghee was added during the process. Next, the roasted ground nuts were combined with the wheat flour, Lauha bhasma, Amalaki churna, Yashtimadhu churna, Trikatu churna, and Guduchi churna in the specified quantities. These ingredients were thoroughly mixed together. The resulting mixture was then poured into plates or moulds that had been greased with ghee.



Figure 1 showing the Ayurveda Nutrition Bar after preparation.

Once the mixture had cooled and hardened into a brittle consistency, it was carefully removed from the plates or moulds and made into pieces weighing about 25 grams.

RESULT & DISCUSSION

Incorporating essential nutrients into a daily diet is crucial for maintaining optimal health and well-being. Each nutrient plays a specific role in the body and contributes to various physiological functions. Here is the importance of incorporating key nutrients into a daily diet:

1. **Iron:** Iron is vital for the production of red blood cells, which carry oxygen throughout the body. Adequate iron intake helps prevent iron deficiency anemia and supports energy metabolism.
2. **Folate (Vitamin B9):** Folate is necessary for the production of DNA, RNA, and red blood cells. It plays a crucial role in cell division and growth, making it essential for proper development and functioning of tissues and organs.
3. **Vitamin B12:** Vitamin B12 is involved in the formation of red blood cells and the maintenance of the nervous system. It is crucial for brain function and the synthesis of DNA and RNA.
4. **Vitamin C:** Vitamin C is an antioxidant that helps protect cells from damage, supports the immune system, and aids in the absorption of iron. It is also important for the production of collagen, a protein that promotes healthy skin, bones, and connective tissues.
5. **Zinc:** Zinc is involved in numerous enzymatic reactions in the body and plays a role in immune function, wound healing, and DNA synthesis. It also supports normal growth and development.
6. **Copper:** Copper is necessary for the production of red blood cells, collagen synthesis, and energy metabolism. It also acts as an antioxidant and plays a role in maintaining healthy connective tissues.
7. **Magnesium:** Magnesium is involved in over 300 biochemical reactions in the body. It supports muscle and nerve function, promotes healthy bones and teeth, regulates blood pressure, and helps maintain a steady heart rhythm.
8. **Other Micronutrients:** Each micronutrient, such as calcium, potassium, vitamin A, vitamin D, vitamin E, manganese, thiamin (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), vitamin B6, biotin (B7), and folate (B9), plays a specific role in the body and contributes to various physiological processes, including energy production, bone health, immune function, and antioxidant protection.

Incorporating these nutrients into a daily diet through a balanced and varied food intake is essential for maintaining overall health, preventing nutrient deficiencies, supporting bodily functions, and reducing the risk of chronic diseases. Keeping this in view, this study has been initiated for the development of an Ayurvedic nutritional snack bar based on the concept of Chikki that offers a promising solution which combines traditional wisdom with modern nutritional science. This study bridges the gap between Ayurveda and nutrition by harnessing the potential of traditional ingredients and formulations to create a convenient and effective solution for improving overall health and well-being.

The selection of ingredients and their respective quantities in the Ayurvedic nutritional snack bar was carefully done to ensure both palatability and consistency. The inclusion of 400 grams of ground nut and 400 grams of jaggery not only adds a delightful taste but also provides a desirable texture to the snack. The addition of 60 grams of ghee helps to enhance the overall flavor profile and contributes to a smooth and consistent texture. Furthermore, incorporating 40 grams of Amalaki churna, 30 grams of yasti churna, 20 grams of Guduchi churna, and 20 grams of Trikatu churna ensures the infusion of beneficial herbs and spices, adding both nutritional value and therapeutic properties to the snack. The measured quantities of wheat flour (20 grams), Lauha bhasma (4 grams), and Ela (6 grams) were carefully chosen to achieve the desired balance of ingredients, resulting in a snack that is not only nutritious but also delicious.

Ground Nut - or peanuts, is a nutrient-dense ingredient packed with protein, healthy fats, fiber, and various micronutrients, including folate, vitamin E, and magnesium. Its inclusion enhances the snack's nutritional profile and contributes to anemia prevention. Ground nut is a rich source of plant-based protein, providing all the essential amino acids required for the body's growth and repair processes. Protein is crucial for building and maintaining muscle mass, supporting the immune system, and facilitating the production of enzymes and hormones. Healthy fats, such as monounsaturated and polyunsaturated fats, are abundantly present in ground nuts. These fats help to improve heart health by reducing LDL (bad) cholesterol levels and increasing HDL (good) cholesterol levels. They also provide a concentrated source of energy and aid in the absorption of fat-soluble vitamins. The presence of folate in ground nuts is particularly significant for anemia prevention. Folate is essential for red blood cell production and the synthesis of DNA and RNA. A deficiency in folate can lead to anemia, characterized by reduced hemoglobin levels and impaired oxygen transport in the body. By including ground nuts in the snack, individuals can benefit from the folate content and support their overall blood health. Vitamin E, another valuable micronutrient in ground nuts, acts as an antioxidant, protecting cells from oxidative damage. It also plays a role in immune function and supports healthy skin. Furthermore, ground nuts are a good source of magnesium, which is involved in over 300 enzymatic reactions in the body. Magnesium contributes to bone health, muscle function, energy metabolism, and the synthesis of DNA and proteins. In addition to being a rich source of Coenzyme Q10, groundnuts are abundant in all 20 amino acids, particularly boasting a high content of arginine. These bioactive compounds have garnered recognition for their disease-preventive properties and are believed to contribute to promoting longevity⁵. By incorporating ground nuts into the snack, it not only enhances its taste and texture but also provides a wide array of nutrients that promote overall health, including anemia prevention, cardiovascular health, and immune support. In Ayurveda, groundnuts are known for their Vata-pacifying qualities. Vata dosha governs bodily movement and is associated with dryness, coldness, and lightness. Groundnuts, with their oily and heavy properties, can help balance Vata by providing grounding, warmth, and lubrication to the body. They are believed to promote the nourishment and rejuvenation of tissues, support muscle development, and enhance overall vitality. Incorporating

groundnuts into the Ayurvedic nutritional snack aligns with the principles of Ayurveda by providing grounding, nourishing, and balancing effects.

Jaggery - a natural sweetener derived from sugarcane, is an excellent source of iron, calcium, and other minerals. Its inclusion in the snack not only enhances the taste but also contributes to combating iron deficiency, a leading cause of anemia. Jaggery is particularly beneficial for individuals with iron deficiency or anemia. Iron is an essential mineral required for the production of hemoglobin, which carries oxygen to the body's tissues. Iron deficiency can lead to fatigue, weakness, and impaired oxygen transport. It provides trace amounts of other minerals such as magnesium, potassium, and phosphorus, which are necessary for various physiological processes in the body. It's important to note that jaggery is a complex carbohydrate that is metabolized more slowly compared to refined sugar. This helps prevent rapid blood sugar spikes and provides a sustained release of energy. It is considered a healthier alternative to refined sugar due to its rich mineral content and unprocessed nature.

Jaggery is acknowledged as a nutraceutical owing to its composition of essential amino acids, antioxidants, phenolics, and minerals such as calcium, phosphorus, and iron, along with various vitamins. With its superior natural sourcing and nutrient content, jaggery serves as a healthier alternative to white sugar, offering notable health benefits. Additionally, the nutraceutical value of jaggery can be further augmented by incorporating medicinally important herbs and spices through value addition and fortification techniques⁶. Jaggery is known as "Guda" in Ayurveda and is valued for its ability to balance Vata and Pitta doshas. By incorporating jaggery into the Ayurvedic nutritional snack, it not only enhances the flavor but also provides important minerals like iron and calcium, contributing to overall nutritional support and addressing iron deficiency, a common concern for individuals at risk of anemia.

Ghee - a clarified form of butter, is derived from cow's milk and is prepared by simmering butter, which helps remove the milk solids and water content, leaving behind a pure and nutrient-rich golden liquid. Ghee is also valued for its ability to nourish and strengthen the body's tissues, including muscles, bones, and joints. It is rich in essential fatty acids, including conjugated linoleic acid (CLA) which is known for its anti-inflammatory and immune-enhancing properties⁷. The presence of butyric acid in ghee supports a healthy gut lining and digestive health. Moreover, ghee is believed to enhance the absorption of fat-soluble vitamins such as vitamin A, D, E, and K, as well as various phytonutrients present in other ingredients. This makes it an ideal ingredient for the Ayurvedic nutritional snack, as it helps optimize the utilization of these important nutrients. In Ayurveda, ghee is known for its ability to balance and nourish all three doshas: Vata, Pitta, and Kapha. It is believed to enhance digestion, improve absorption of nutrients, and support the body's natural detoxification processes. Ghee is considered "Sattvic" in nature, promoting clarity of mind, spiritual growth, and overall vitality. By including ghee in the snack, it not only adds a rich and delicious taste but also provides Ayurvedic therapeutic benefits, promoting digestion, nutrient absorption, and overall nourishment.

Amalaki Churna also known as Amla powder derived from the Indian Gooseberry (Amla), is a rich source of vitamin C, antioxidants, and minerals. Its inclusion in the snack enhances its nutritional content and supports immune function. It is considered a potent Rasayana (rejuvenative) herb that promotes vitality and overall well-being. Amalaki churna is particularly valued for its high vitamin C content. Vitamin C is a powerful antioxidant that plays a crucial role in supporting immune function, protecting against oxidative stress, and enhancing the body's ability to fight infections and diseases. Vitamin C also promotes the absorption of Iron in the gut. Amalaki churna is a rich source of antioxidants, such as polyphenols, flavonoids, and tannins. These antioxidants help neutralize harmful free radicals, protect cells from damage, and support cellular health. Research studies have highlighted the immune-boosting properties of Amalaki churna. A research study demonstrated the immunomodulatory effects of amla extract, indicating its potential in enhancing immune response and promoting overall health. Amla extract exhibits promising potential in reducing total cholesterol (TC) and triglyceride (TG) levels, along with improving lipid ratios, atherogenic index of plasma (AIP), and apoB/apoA-I ratio in individuals with dyslipidemia. This suggests its potential in addressing both general and diabetic dyslipidemia, providing opportunities for therapeutic interventions⁸. In addition to its immune-supporting properties, Amalaki churna contains essential minerals, including calcium, iron, and phosphorus, which contribute to the overall nutritional value of the snack.

Yasti Churna or Yastimadhu churna also known as licorice powder, is a well-known Ayurvedic herb with anti-inflammatory and rejuvenating properties. It aids digestion, balances the doshas, and adds a distinctive flavor to the snack. Yasti churna, derived from the root of the licorice plant (*Glycyrrhiza glabra*), has been used in Ayurvedic medicine for its therapeutic benefits for centuries. In Ayurveda, it is considered a "Rasayana" herb, promoting overall health and well-being. It balances the doshas, particularly Pitta and Vata. It is known for its cooling properties, which help soothe inflammation and maintain optimal dosha balance. Moreover, Yasti churna is known for its digestive properties. It helps stimulate digestion, alleviate digestive discomfort, and support gastrointestinal health. It aids in the absorption of nutrients and promotes a healthy digestive system. Research studies have highlighted the anti-inflammatory properties of Yasti churna. A study investigated the anti-inflammatory effects of licorice extract and found that it exhibited significant anti-inflammatory activity by inhibiting the release of pro-inflammatory molecules⁹. By incorporating Yasti churna into the Ayurvedic nutritional snack, it not only contributes to the overall flavor but also provides therapeutic benefits, supporting digestion, promoting dosha balance, and adding its anti-inflammatory properties. The inclusion of Yasti churna, or licorice powder, in the Ayurvedic nutritional snack aligns with Ayurvedic principles of promoting digestion, balancing the doshas, and adding therapeutic benefits. Its anti-inflammatory and rejuvenating properties enhance the overall value of the snack.

Wheat Flour: Wheat flour is a staple ingredient in many cultures and is a good source of carbohydrates, which serve as the body's primary source of energy. Rich in complex carbohydrates, fiber, and B-vitamins, wheat flour forms the base of the snack, providing sustained energy and essential

nutrients. It is known to provide energy, and strength to the body. The complex carbohydrates in wheat flour are digested slowly, providing a steady release of glucose into the bloodstream and helping to maintain stable blood sugar levels. In addition to carbohydrates, wheat flour is also a good source of dietary fiber. Fiber plays a crucial role in promoting healthy digestion, preventing constipation, and supporting overall gut health. It adds bulk to the stool, aids in regular bowel movements, and may help lower the risk of certain digestive disorders such as diverticulitis and colon cancer. From a nutritional standpoint, the fractions of wheat bran obtained through milling are abundant in various essential components. These include fiber, minerals, vitamin B6, thiamine, folate, vitamin E, and certain phytochemicals, specifically antioxidants like phenolic compounds¹⁰. These vitamins are essential for energy production, nerve function, DNA synthesis, and the formation of red blood cells. They also contribute to the health of the skin, hair, and nails. In Ayurveda, wheat flour (Godhuma churna) is considered a nourishing and grounding food that provides stability and sustenance to the body. It is classified as Madhura (sweet) and Sheeta (cooling) in taste and potency, respectively. It is believed to balance the Vata and Pitta doshas, while it can increase Kapha in excess. It is rich in Prithvi (earth) and Apa (water) elements, which contribute to its stability and nourishing properties. By including wheat flour in the snack, it provides a satisfying texture, helps to bind the mixture together, and also contributes to the overall nutritional value, promoting sustained energy release and supporting various bodily functions.

Guduchi Churna: Derived from the herb *Tinospora cordifolia*, is known for its immunomodulatory and antioxidant properties. Its inclusion in the snack adds a therapeutic touch, supporting overall well-being and boosting the body's natural defences. Guduchi churna, also known as Giloy churna, is a significant herb in Ayurvedic medicine. It has been traditionally used for its beneficial effects on the immune system and as a rejuvenating tonic. In Ayurveda, it is considered an adaptogen, helping the body adapt to stress and maintain balance. Guduchi churna is believed to support digestion, detoxification, and overall vitality. It is considered a "Rasayana" herb, promoting longevity, strength, and optimal functioning of bodily systems. Research studies have provided insights into the immune-enhancing properties of Guduchi churna. A published study explored the immunomodulatory effects of Guduchi churna. The researchers found that Guduchi churna supplementation increased the activity of immune cells and enhanced the production of immune-regulating molecules¹¹. Furthermore, Guduchi churna exhibits potent antioxidant activity, which helps neutralize harmful free radicals and protect the body from oxidative stress. The antioxidants present in Guduchi churna contribute to its overall health-promoting effects. By incorporating Guduchi churna into the Ayurvedic nutritional snack, it adds a therapeutic dimension, supporting the body's immune system, providing antioxidant benefits, and promoting overall well-being.

Trikatu Churna: It is a classic Ayurvedic formulation consisting of three potent spices: black pepper (*Piper nigrum*), long pepper (*Piper longum*), and ginger (*Zingiber officinale*). Each of these spices contributes unique health benefits to the blend. It aids digestion, improves metabolism, and adds a

warm and pungent flavor to the snack. Black pepper (Maricha in Ayurveda) is known for its digestive properties. It stimulates the secretion of digestive enzymes, promotes gastrointestinal motility, and helps alleviate digestive discomfort. It also possesses antioxidant and antimicrobial properties, which support overall digestive health. Long pepper, also known as pippali, is valued for its bioavailability-enhancing properties¹². It improves the absorption and assimilation of nutrients, aids digestion, and helps maintain a healthy metabolism. Long pepper has been traditionally used in Ayurveda to support respiratory health, digestion, and overall well-being. Ginger is renowned for its digestive and anti-inflammatory properties. It helps stimulate digestive enzymes, reduce bloating and gas, and soothe gastrointestinal discomfort. Ginger also possesses antioxidant and anti-inflammatory properties, contributing to its overall health benefits. The combination of these three spices in Trikatu churna creates a powerful digestive blend. It helps improve digestion, increase metabolic efficiency, and support the body's digestive fire, known as Agni, which is essential for proper nutrient absorption and overall well-being. The warm and pungent flavor of Trikatu churna adds a delightful taste to the snack, enhancing its overall sensory experience. The inclusion of Trikatu churna, a blend of black pepper, long pepper, and ginger, in the Ayurvedic nutritional snack aligns with Ayurvedic principles of promoting digestion, metabolism, and overall well-being. Its digestive properties and unique flavor make it a valuable addition to the snack.

Lauha Bhasma: a calcined iron preparation, contributes to replenishing iron stores in the body, addressing iron deficiency, and supporting the prevention of anemia. It is a unique Ayurvedic preparation wherein the iron from its metallic state is converted into an oxidized state after thorough purification, which is completely homologous to the body when judiciously used. This process enhances the bioavailability and assimilation of iron, making it easier for the body to absorb and utilize. Study conducted on Lauha bhasma states that the Lauha bhasma could potentially demonstrate higher effectiveness in the treatment of anemia in humans when compared to commonly used ferrous-based compounds¹³. In Ayurveda, Lauha bhasma is considered a valuable ingredient for addressing iron deficiency and preventing anemia (Pandu being the nearest clinical correlation in Ayurveda). Research studies have demonstrated the efficacy of Lauha bhasma in addressing iron deficiency and improving hemoglobin levels. By incorporating Lauha bhasma into the Ayurvedic nutritional snack, it contributes to the snack's nutritional content, helps fulfill the body's iron requirements, and supports the replenishment of iron stores, addressing iron deficiency and preventing anemia.

Ela: or cardamom, adds a delightful aroma and taste to the snack. It is known for its digestive properties and contributes to a balanced flavor profile. It is a highly aromatic spice that adds a unique and pleasant flavor to the Ayurvedic nutritional snack. It has been valued for centuries in Ayurveda for its medicinal properties and culinary uses. In addition to its enticing aroma and taste, Ela possesses digestive properties that aid in improving digestion and relieving gastrointestinal discomfort. It helps stimulate the secretion of digestive enzymes, promoting better nutrient absorption and assimilation.

Cardamom and its active compounds have demonstrated a wide range of beneficial effects, encompassing antihypertensive, antioxidant, lipid-modifying, anti-inflammatory, anti-atherosclerotic, anti-thrombotic, hepatoprotective, anti-obesity, hypocholesterolemic and antidiabetic properties¹⁴. It also contributes to the overall flavor profile of the snack, balancing the taste and enhancing the sensory experience. Its presence not only adds a delightful aroma but also complements the other ingredients, creating a harmonious blend of flavors.

The sample was submitted to the laboratory for the comprehensive assessment of specific nutrients present in the Nutrition bar. The subsequent reports elucidate the findings of the analysis, shedding light on the composition and content of the nutrients present in the Chikki (Annexure 1).

The following table presents a comparative analysis of the nutritional composition of Chikki, highlighting its content per 100 grams (as mentioned in the FSSAI notified laboratory) and per 25 grams. Additionally, it provides the Recommended Daily Allowances (RDA) for a 60kg adult male as a reference. The 'Daily Nutritional Achievement with 25g Chikki' column indicates the percentage of fulfilment of the RDAs by consuming one piece of Chikki weighing 25 grams. This information helps assess the nutritional value and contribution of Chikki towards meeting daily dietary requirements.

Parameters	RDA for 60kg adult male	In 100 grams	In 25 grams	Daily Nutritional Achievement with 25g Chikki
1 Caloric value	2000	406	101.50	5%
2 Carbohydrates	900	64.74	16.18	2%
3 Proteins	50	9.58	2.39	5%
4 Fats	50	12.16	3.04	6%
5 Calcium	1000	96.90	24.22	2%
6 Iron	8	12.25	3.06	38%

1. Caloric value: A 100g portion of Chikki contains 406 calories, while a 25g portion provides 101.5 calories. This means that consuming 25g of Chikki fulfils approximately 5% of the recommended daily caloric intake.
2. Carbohydrates: Chikki contains 64.74g of carbohydrates per 100g and 16.185g per 25g. Consuming 25g of Chikki contributes around 2% towards meeting the daily carbohydrate requirement, which is recommended to be 900g.
3. Proteins: Chikki provides 9.58g of protein per 100g and 2.395g per 25g. Consuming 25g of Chikki helps fulfil approximately 5% of the daily protein requirement, which is recommended to be 50g.
4. Fats: A 100g portion of Chikki contains 12.16g of fat, while a 25g portion provides 3.04g. Consuming 25g of Chikki contributes around 6% towards meeting the daily fat requirement, which is recommended to be 50g.
5. Calcium: Chikki contains 96.9mg of calcium per 100g and 24.225mg per 25g. Consuming 25g of Chikki fulfils approximately 2% of the daily calcium requirement, which is recommended to be 1000mg.
6. Iron: A 100g portion of Chikki contains 12.25mg of iron, while a 25g portion provides 3.0625mg. Consuming 25g of Chikki contributes approximately 38% towards meeting the daily iron requirement, which is recommended to be 8mg.

In summary, consuming 25 grams of the Chikki contributes to a small percentage of the recommended daily allowances for calories, carbohydrates, proteins, fats, calcium, and fulfils a significant portion of the daily iron requirement.

The overall benefits of the snack bar can be summarized as:

- Anemia prevention: Anemia is a common nutritional deficiency characterized by a low level of red blood cells or hemoglobin in the body. The snack includes ingredients rich in iron, such as jaggery and Lauha bhasma, which can help address iron deficiency and prevent anemia.
- Immune system support: Several ingredients in the snack, such as Amalaki churna and Guduchi churna, possess immunomodulatory and antioxidant properties. These herbs may support the body's natural defence mechanisms and strengthen the immune system.
- Digestive health: The inclusion of ingredients like Trikatu churna and Ela (cardamom) in the snack can aid digestion, improve metabolism, and promote overall digestive health. These ingredients may help alleviate digestive discomfort and support optimal nutrient absorption.
- Rejuvenation and vitality: Ayurvedic herbs like yasti churna (licorice powder) are known for their rejuvenating properties. These herbs may help restore energy levels, promote vitality, and support overall well-being.
- Nutritional support: The snack is designed to provide essential nutrients, including carbohydrates, proteins, fats, vitamins, and minerals. These nutrients are important for overall health, energy production, and the proper functioning of bodily systems.

CONCLUSION

Chikki is a traditional Indian sweet snack that combines jaggery with nuts, seeds, or grains. It offers a delightful crunch, rich flavor, and several nutritional benefits. Whether enjoyed as a treat or during festive celebrations, Chikki is a popular and wholesome snack choice in Indian cuisine. The combination of these ingredients in the Ayurvedic nutritional snack offers a holistic approach to wellness, incorporating Ayurvedic principles and nutritional science. It provides a balanced blend of macronutrients, micronutrients, and bioactive compounds, promoting overall health and vitality. The development of an Ayurvedic nutritional snack incorporating traditional ingredients modified for modern use presents an exciting opportunity to prevent anemia and support nutritional growth. By utilizing the therapeutic properties of Groundnut, Jaggery, Wheat Flour, Ghee, Guduchi Churna, Yasti Churna, Amalaki Churna, Trikatu Churna, Lauha Bhasma, and Ela, this snack offers a holistic approach to nutrition and well-being. It involved a careful selection of ingredients based on their nutritional value and compatibility with Ayurvedic principles. Each ingredient was chosen for its specific health benefits and ability to contribute to the overall nutritional profile of the snack. The selection process took into consideration traditional Ayurvedic knowledge, scientific research, and the availability of ingredients. Two key ingredients, jaggery and ground nut, were incorporated into the snack to enhance both its nutritional value and taste. Jaggery, a natural sweetener derived from sugarcane, provided not only a pleasant

sweetness but also a rich source of iron, calcium, and other minerals. Ground nut, or peanuts, contributed to the snack's nutritional profile with protein, healthy fats, fiber, and various micronutrients, including folate, vitamin E, and magnesium. By adding other ingredients, the snack became a wholesome and nourishing option that addressed the nutritional needs associated with anemia prevention and overall health maintenance.

The Ayurvedic nutritional snack underwent nutritional analysis to determine its composition and evaluate its potential health benefits. The analysis included the determination of macronutrients (carbohydrates, proteins, and fats), micronutrients (Iron and calcium).

The results of the nutritional analysis provided valuable insights into the snack's nutritional profile. It revealed the presence of essential nutrients such as carbohydrates for energy, proteins for tissue repair and growth, fats for energy and nutrient absorption, and a range of vitamins and minerals that contribute to overall health and well-being. The nutritional analysis confirmed that the Ayurvedic nutritional snack was a well-rounded and balanced dietary option, rich in essential nutrients that support nutritional growth, anemia prevention, and overall health. Research and exploration of such innovative formulations hold the potential to bridge the gap between traditional Ayurveda and modern nutritional science, paving the way for enhanced preventive healthcare practices.

The Ayurvedic nutritional snack offers advantages in terms of accessibility and palatability compared to traditional Ayurvedic medicines or supplements. Accessibility refers to the ease of obtaining and incorporating the snack into daily routines, while palatability refers to its taste and overall sensory appeal which is appreciated in the snack. It is important to exercise caution and moderate the consumption of Chikki to a maximum of three pieces per day, considering that each Chikki provides 38% of the daily requirement of Iron. By adhering to this recommended limit, individuals can ensure a balanced intake of Iron without exceeding the appropriate daily intake.

In conclusion, the Ayurvedic nutritional snack holds the potential to be a convenient and effective Ayurvedic nutritional supplement. Its accessibility, palatability, and alignment with Ayurvedic principles make it an appealing option for individuals seeking a holistic approach to nutrition and well-being. However, further research and studies are necessary to validate its effectiveness and potential impact as a nutritional supplement. This snack not only satisfies the taste buds but also nourishes the body, making it a wholesome and nutritious choice for individuals seeking a balanced and Ayurvedic-inspired snack. By combining traditional Ayurvedic ingredients with evidence-based nutritional knowledge, we bridge the gap between traditional wisdom and contemporary dietary needs.

Additional research is warranted to evaluate the nutritional values like Vitamin C, B1, B2, B5, B6, and folate in the context of this Chikki. Conducting a comparative clinical trial involving anemic subjects, both with and without the inclusion of this Chikki in conjunction with regular medications, would provide valuable insights into the efficacy of the Chikki in managing anemia and other nutritional health issues. Such

studies will have the potential to shed light on the specific benefits and potential synergistic effects of incorporating Chikki into the treatment or supportive regimen for anemic and other nutritional disorders individuals.

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