

## Formulation and Evaluation of Anti-anaemic Sports drink

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### Abstract:

A frequent nutritional condition in humans, anaemia is characterized by a drop in haemoglobin levels, which reduces the blood's ability to carry oxygen. It is still a major public health concern, particularly in developing countries like India. The development and evaluation of a herbal anti-anaemia energy drink made with natural ingredients such as beetroot powder, pumpkin seed powder, amla powder, black sesame seed powder, ginger powder, ashwagandha (*Withania somnifera*), chia seeds, and creatine phosphate forms the basis of the current study. These components enhance haemoglobin production and improve overall health since they are a rich source of iron, vitamins, antioxidants, and bioactive phytoconstituents.

Standard techniques, such as cleaning, drying, grinding, sieving, and combining ingredients, were used to make the formulation. To ascertain the physicochemical properties of both individual components and the final formulation, evaluation metrics such as flow properties (bulk density, tapped density, angle of repose, Carr's index, and Hausner's ratio) were examined. Important components with proven medicinal potential, such as flavonoids, tannins, phenols, alkaloids, saponins, and proteins, were found through phytochemical screening.

With enhanced bioavailability, fewer adverse effects, and extra health advantages like antioxidant and anti-inflammatory properties, the created herbal formulation seeks to offer a natural, safe, and efficient substitute for synthetic iron supplements. This study demonstrates how plant-based formulations might improve energy levels and manage anaemia.

**Keywords:** Herbal anti-anaemia drink, Plant based energy drink, Herbal food booster, Ayurvedic energy tonic, Iron rich herbal formulation, Natural iron supplements.

### 1. Introduction:

Anaemia is defined by a reduction in haemoglobin (Hb) levels in the bloodstream, typically falling below 13.5 g/dL for men and 12.5 g/dL for women, which leads to a decreased capacity for oxygen transport. Conditions that hinder Hb production, such as deficiencies in iron, B12, or folate, or those that increase its breakdown, are frequently caused by abnormalities in the Hb structure [1]. Anaemia represents a widespread nutritional deficiency issue and a significant public health challenge worldwide, impacting both developing and developed nations with serious repercussions for human

health and the advancement of social and economic progress [2]. Per the 2004 WHO findings, anaemia affects roughly one-third of the world's population, exceeding 2 billion individuals, primarily due to inadequate dietary nutrition [3]. The WHO also indicates that within South Asia, India exhibits the most widespread incidence of anaemia. Importantly, nearly 50% of global maternal fatalities linked to anaemia take place in South Asian nations; India alone accounts for approximately 80% of these maternal deaths in the region [4].

**Herbal beverage:** Herbal beverages are drinks made from natural ingredients sourced from different morphological parts of plants, such as leaves, stems, roots, fruits, buds, and flowers [5]. They are rich in bioactive compounds like flavonoids, phenolics, tannins, etc. They have lesser side effects as compared to synthetic one.

## 2. Advantages of natural iron sources:

- 1) Improved bioavailability with synergistic nutrients: Natural sources of iron include bioavailability boosters like vitamin C, polyphenols, and organic acids, which enhance iron absorption in the digestive system [6].
- 2) Decreased gastrointestinal side effects: In contrast to synthetic iron supplements, natural sources tend to cause less nausea, constipation, or stomach discomfort, making them easier to tolerate for extended use.
- 3) Antioxidant and anti-inflammatory characteristics: Sources of plant-based iron frequently include polyphenols, flavonoids, and vital fatty acids that offer antioxidant and anti-inflammatory advantages, aiding in the reduction of oxidative stress linked to iron metabolism. [7].
- 4) Controlled absorption: In contrast to synthetic iron supplements that can cause excessive iron buildup and toxicity, natural sources facilitate improved regulation via hepcidin-mediated mechanisms, lowering the likelihood of iron overload [8].
- 5) Support for gut microbiota: Natural sources of iron, particularly from plant-based foods, enhance a healthy gut microbiome that is essential for iron metabolism and absorption [9].
- 6) Eco-friendly and sustainable: Numerous plant-based sources of iron, including pumpkin seeds, legumes, and leafy greens, provide a sustainable and environmentally friendly option compared to synthetic iron supplements.
- 7) Incorporation into functional foods: Natural sources of iron can be added to enhanced food items like fortified cereals, bread, and dairy substitutes, increasing the accessibility and convenience of iron consumption.

## 3. Resources applied:

- 1) Beetroot powder
- 2) Pumpkin seed powder
- 3) Amla powder
- 4) Black sesame seed powder
- 5) Ginger powder
- 6) Ashwagandha powder

7)Chia seed

8)Creatine phosphate

9)Pink salt

### 1)Beetroot powder:



Fig1.(a)and (b)shows fresh and sliced beetroot respectively

**Family:** Chenopodiaceae (Amaranthaceae)

**Synonyms:** Beet, chard, spinach beet, sea beet, garden beet, white beet and Chukander (in Hindi).

**Biological source:** Beetroot is the edible taproot of the plant species Beta Vulgaris L.

**Uses:** antioxidant, antidepressant, antimicrobial, antifungal, anti-inflammatory, diuretic, expectorant, and carminative effects.

### 2) Pumpkin seed powder:



Fig 2. Pumpkin, pumpkin seeds and powder

**Family:** Cucurbitaceae

**Synonyms:** winter squash

**Biological source:** Pumpkin seeds are the edible seeds derived from various species of the Cucurbita genus, primarily Cucurbita pepo.

**Uses:** anti-inflammatory, antioxidant, antiviral, and anti-diabetic

### 3)Amla powder:



Fig 3. Amla and its powder

**Family:** Euphorbiaceae

**Synonyms:** Phyllanthus emblica or Indian gooseberry.

**Biological source:** Amla is derived from the fresh or dried fruits of Phyllanthus emblica Linn.

**Uses:** rich in vitamin C, Hair Maintenance, Vision Care, Respiratory Wellness, Blood Purifier, Enhances Digestion, Absorbs Calcium, Heart Protective Action, Diabetes Prevention Effect, Cancer Prevention Effect, Inflammation Reduction Effect, Neurological Safeguard.

#### 4) Black sesame seed powder:



Fig 4. Black sesame seeds and its powder

**Family:** Pedaliaceae

**Synonym:** kala til (Hindi), Benne, Gingelly, Simsim.

**Biological source:** Black sesame seeds are derived from the plant *Sesamum indicum* L.

**Uses:** Antioxidant activity, antihyperlipidemic action, antihyperglycemic action, property of lowering blood pressure.

#### 5)Ginger powder:



Fig 5. Ginger and its powder

**Family:** Zingiberaceae

**Synonyms:** Zingiber

**Biological source:** Ginger consists of the dried or fresh rhizomes of the plant *Zingiber officinale* Roscoe.

**Uses:** Antiviral action, Relief from nausea, Immune system support, Antioxidant qualities, Anti-inflammatory characteristics.

**6) Ashwagandha powder:**

Fig 6. Ashwagandha roots and its powder

**Family:** Solanaceae

**Synonyms:** Indian Ginseng, Winter cherry or Ajagandha.

**Biological source:** Ashwagandha consists of the dried root and stem bases of *Withania somnifera* Dunal.

**Uses:** Anti-inflammatory, Stress-relieving, Microbial-inhibiting, Immune-modulating, Cancer-fighting, liver-protective, antioxidative, arthritis-relieving, ulcer-preventive.

**7) Chia seeds:**

Fig 7. Chia seeds

**Family:** Mint (Lamiaceae)

**Synonyms:** Spanish sage seed, chia beej (Hindi)

**Biological source:** Chia seeds are the edible seeds of *Salvia hispanica* L.

**Uses:** : High in omega-3, Contains dietary fiber, supports heart health, Aids in managing blood sugar.

**8) Creatine phosphate:** Phosphocreatine, also known as creatine phosphate (CP) or (PCr) is a phosphorylated form of creatine that serves as a rapidly mobilizable reserve of high energy phosphates in skeletal muscle, myocardium and the brain to recycle ATP, the energy currency of the cell.

**9) Pink salt:** Pink salt helps replenish lost electrolyte (especially after sweating or fatigue), improve hydration efficiency, and support muscle and nerve function.

#### 4. Method of preparation:

1. Selection of raw material.
2. Clean/wash the ingredients.
3. Dry the ingredients (Sun drying).
4. Grind ingredients into fine powder (For small scale mortar pestle or grinder used).
5. Pass the powder from sieve to get fine powder.
6. Then mix all powder to get final preparation.

#### 5. FORMULA:

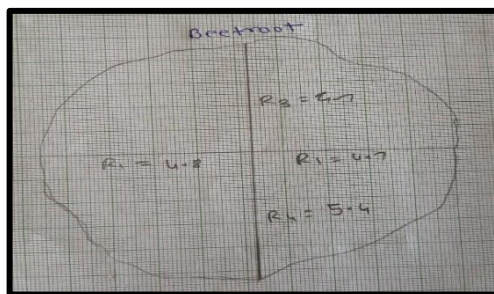
SR.NO.	INGREDIENTS	ROLE	QUANTITY
1	Beetroot powder	Haemoglobin booster (iron source)	4 g
2	Pumkin seed powder	RBC formation and iron supplements	2 g
3	Amla powder	Enhance iron absorption (vitamin C)	1.5 g
4	Sesame seed powder	Increase haemoglobin (iron source)	1.5 g
5	Ginger powder	Improve digestion and absorption	500 mg
6	Ashwagandha powder	Energy booster and reduces fatigue	500 mg
7	Chia seeds	Provides sustained energy	2 g
8	Pink salt	Maintains electrolyte balance	300 mg
9	Creatine phosphate	Rapid energy supply (ATP production)	3 g

#### 6. Evaluation parameter and Result:

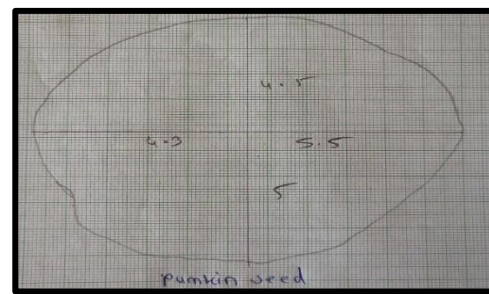
- 1) Bulk density (g/ml) =  $\frac{\text{Weight of sample (W)}}{\text{Bulk density (V)}}$
- 2) Tapped density (g/ml) =  $\frac{\text{Weight of sample (W)}}{\text{Tapped volume (V2)}}$
- 3) Angle of repose =  $\tan\theta = h/r$
- 4) Carr's index (%) =  $\frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 10$
- 5) Hausner's ratio =  $\frac{\text{Tapped density}}{\text{Bulk density}}$

Sr.No.	Powder name	Bulk density	Tapped density	Angle of repose	Carr's index	Hausner's ratio
1	Beetroot powder	0.49 g/ml	0.62 g/ml	31.4°	20%	1.26
2	Pumkin seed powder	0.46 g/ml	0.56 g/ml	38.3°	17%	1.21
3	Amla powder	0.44 g/ml	0.69 g/ml	38.3°	36%	1.56
4	Ginger powder	0.40 g/ml	0.83 g/ml	45.6°	51%	0.33
5	Black sesame seed powder	0.40 g/ml	0.49 g/ml	33.8°	18%	1.22
6	Ashwagandha powder	0.35 g/ml	0.48 g/ml	32.2°	27%	1.37
7	Final prepared powder	0.31 g/ml	0.5 g/ml	43.3°	38%	1.61

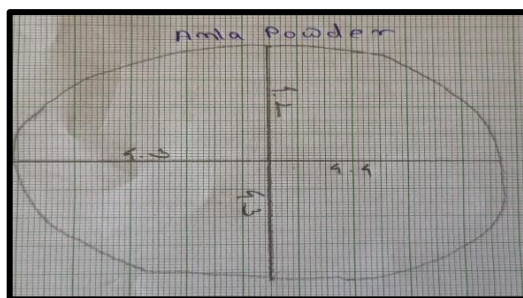
**Graphs of angle of repose:**



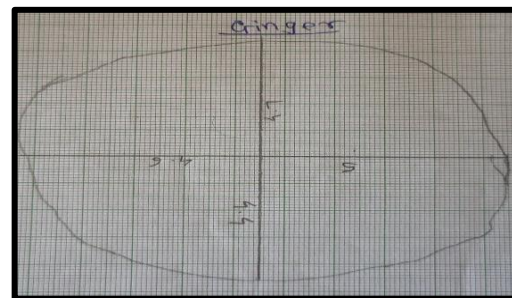
Beetroot powder graph



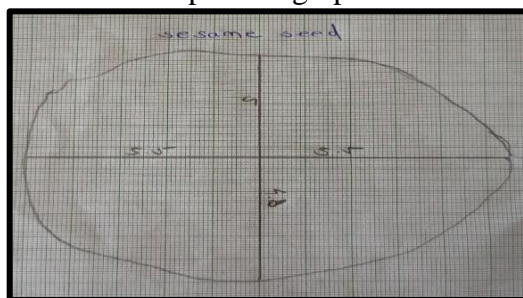
Pumkin seed powder graph



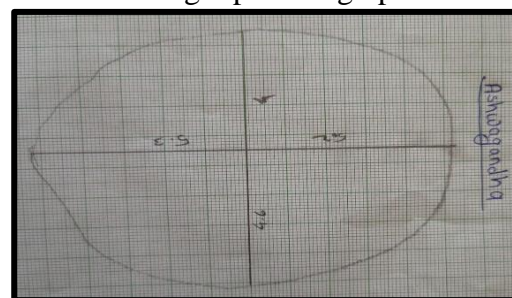
Amla powder graph



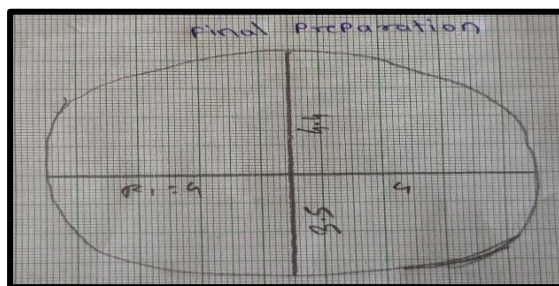
Ginger powder graph



Black sesame powder graph



Ashwagandha powder graph



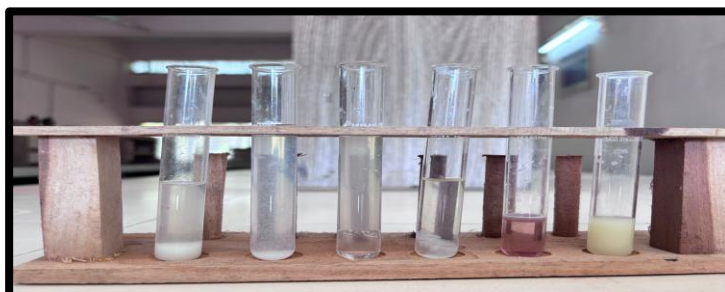
Final preparation powder graph

## 7. Chemical test

1] Chemical test of beetroot powder:



2] Chemical test of pumkin seed powder:



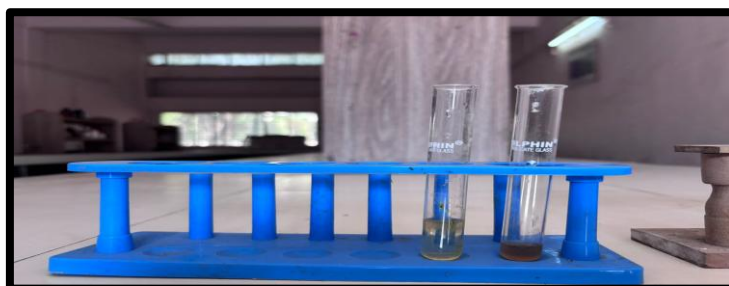
3] Chemical test of amla powder:



4] Chemical test of black sesame seed powder:



5] Chemical test of ginger powder:



6] Chemical test of ashwagandha powder:



7] Chemical test of final preparation:



## 8 Phytochemicals test:

INGREDIENTS	CHEMICAL TEST	PHYTOCHEMICALS PRESENT
Beetroot powder	Test for tannin, test for saponin, test for quinone, test for flavonoid, test for phenol, test for coumarins, test for betacyanins.	Tannin, saponin, quinone, flavonoid, phenol, coumarin, betacyanin.
Pumkin seed powder	Mayer's test, test for protein, test for flavonoid, test for terpenoid, test for saponin, test for tannin.	Alkaloid, protein, flavonoid, terpenoid, saponin, tannin.
Amla powder	Ferric chloride test, ferric chloride test, salkowski test, test for coumarin.	Phenol, tannin, terpenoid, Coumarin.
Black sesame seed powder	Test for volatile oil, wagner's test, 1% lead acetate test.	Volatile oil, alkaloid, flavonoid.
Ginger powder	Wagner's test, test for flavonoid	Alkaloid, flavonoid.
Asgwagandha powder	Test for flavonoid, ferric chloride test, test for saponin, biuret test.	Flavonoid, tannin, saponin, Protein.
Final prepared powder	Xanthoprotein test, biuret test.	Confirms presence of Protein.

## 9. Conclusion:

The developed herbal anti-anaemia energy beverage shows encouraging potential as a natural and efficient solution for managing anaemia. The blend of plant sources high in iron and bioactive phytoconstituents boosts haemoglobin production and aids in red blood cell formation. The existence of compounds like flavonoids, tannins, and phenolics enhances antioxidant activity, thus decreasing oxidative stress linked to anaemia.

The assessment of physicochemical traits shows that the formulation has satisfactory flow properties appropriate for additional processing and use. Phytochemical analysis verifies the existence of crucial therapeutic substances that are important for enhancing general health and immunity.

In contrast to standard iron supplements, the herbal formula provides benefits like enhanced tolerability, fewer digestive side effects, and superior nutrient uptake due to synergistic elements such as vitamin C. Furthermore, the addition of energy-boosting components aids physical endurance and alleviates fatigue usually linked to anaemia.

In general, this research endorses the utilization of polyherbal combinations as a secure, economical, and sustainable method for managing anaemia. Additional clinical trials are suggested to confirm its effectiveness and set standardized dosing for therapeutic application.

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