

# Formulation And Evaluation of an Herbal Protein Bar

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**Abstract**—he works here is centered on the development and assessment of a natural herbal protein bar made from enriched plant-based natural ingredients with cardioprotective, anti-inflammatory, and antioxidant activity. The protein bar was prepared with watermelon seed, ashwagandha, peanut, soybean powder, nuts, chickpea powder, sesame seeds, dark chocolate, jaggery, dates. These ingredients are good sources of proteins, healthy fats, dietary fiber, vitamins, minerals, and bioactive molecules such as polyphenols, flavonoids, and essential fatty acids. The preparation was done by roasting and grinding dry ingredients, combining with heat-treated jaggery and dates shaping into bars. The final product was analyzed for organoleptic attributes (taste, color, texture, aroma), nutritional content (protein, fat, carbohydrate, fiber), and functional activities like antioxidant activity using DPPH assay and literature-based health claim. The findings indicated that the bars were well balanced nutritionally, high in protein, and acceptable by senses. The presence of, sesame, and dark chocolate contributed significantly to antioxidant potential, while soy, watermelon seeds, and nuts supported heart health and antiinflammatory benefits. This herbal protein bar can serve as a nutritious and functional snack that promotes overall health and wellness while catering to the growing demand for natural, plantbased foods.

**Index Terms**—Herbal protein bar, cardioprotective, antioxidant, anti-inflammatory, plantbased, watermelon seeds, soy protein, functional food.

## I. INTRODUCTION

There is increasing need for healthy, convenient, and nutritionally functional foods in today's busy life. Among them are functional foods, which provide health benefits over and above ordinary nutrition. Protein bars, specifically, are a popular choice among fitness enthusiasts, athletes, and working professionals because they are easy to consume, easy to carry about, and rich in nutrients.

The growing consciousness about lifestyle diseases like cardiovascular diseases, inflammation, and oxidative stress has stimulated consumer choice towards plant and herbal components possessing their functional and therapeutic characteristics. Apart from delivering necessary nutrients like proteins, fiber, and beneficial fats, these natural ingredients also provide bioactive compounds possessing cardioprotective, antioxidant, and anti inflammatory properties. This work is to create a herbal protein bar through a blend of functional ingredients that are: Watermelon

seed powder – Packed with plant protein, magnesium, and omega-6 fatty acids, promotes heart health.

Soybean powder – A long-standing source of whole plant protein, has cholesterol-lowering and anti-inflammatory properties Nuts powder (almonds, pistachio, walnuts) – Supply essential fatty acids, antioxidants, and micronutrients that guard against heart disease.

Chickpea powder – Supplements dietary fiber and plant protein, enhances digestion and inflammation reduction.

Ashwagandha powder - anti-inflammatory, and neuroprotective properties, with numerous studies exploring its effects on stress, anxiety, and neurodegenerative disorders.

Pumkin seed - packed with plant protein Rich in antioxidants, improve heart health, blood sugar levels, fertility, and sleep quality. protect against certain types of cancer.

Peanut - rich source of protein, fiber, antioxidants, and healthy fats that support heart health by lowering bad cholesterol, aiding in weight management by promoting fullness, regulating blood sugar, and

providing nutrients crucial for brain and digestive health

Sesame seeds – Rich in lignans and healthy fats to lower blood pressure and oxidative stress.

Dark chocolate – High in flavonoids and adds antioxidant activity and flavor.

Jaggery – Serves as a natural sweetener and source of energy. . Importance of Proteins in the Human Body  
Proteins perform a wide range of physiological functions, making them one of the most vital.

nutrients for humans. They are responsible for building and repairing tissues, producing enzymes and hormones, maintaining fluid balance, and supporting immune function. During growth, illness, or intense physical activity, the body's demand for protein increases significantly. A deficiency of protein can lead to muscle wasting, fatigue, weakened immunity, delayed wound healing, and in severe cases, conditions such as kwashiorkor and marasmus. Therefore, ensuring an adequate intake of protein is necessary for maintaining overall health and vitality. In the modern diet, many people rely on protein supplements, but synthetic or animal-based products may not be suitable for everyone. This has encouraged the exploration of herbal and plant-based protein sources, which are rich in nutrients and align with a natural lifestyle.

## II. ROLE OF HERBAL PROTEIN IN HUMAN HEALTH

Herbal proteins play a vital role in maintaining overall health and wellness by combining the benefits of plant based nutrition and medicinal herbs. They serve as a natural, safe, and effective alternative to synthetic protein supplements.

1. Supports Muscle Growth and Repair: Herbal proteins from sources like soybean, chickpea, and pumpkin seeds provide essential amino acids that help in the repair and building of body tissues and muscles.

2. Boosts Energy Levels: They act as a natural energy source, improving stamina and endurance, which is especially beneficial for athletes, gym-goers, and physically active individuals.

3. Strengthens the Immune System: Herbal ingredients such as ashwagandha enhance the body's immune response, helping to fight infections and maintain overall health.

4. Promotes Digestive Health: Being plant-based and fiber-rich, herbal proteins are easy to digest and support healthy metabolism without causing bloating or heaviness.

5. Aids in Weight Management: Herbal protein helps in controlling appetite and promoting satiety, making it effective for people aiming to reduce or maintain weight.

6. Provides Antioxidant and Anti-inflammatory Benefits: Many herbal ingredients contain natural antioxidants that help remove harmful free radicals, reducing oxidative stress and inflammation in the body.

7. Regulates Hormonal Balance:

Certain herbs like ashwagandha help in maintaining hormonal balance, reducing stress, and supporting mental health. Role of Herbal Protein Bar in Cardiovascular Health Cardiovascular health refers to the proper functioning of the heart and blood vessels, ensuring efficient circulation of blood, oxygen, and nutrients throughout the body. In recent years, lifestyle disorders such as high cholesterol, hypertension, and atherosclerosis have become common due to poor diet and sedentary habits. One effective dietary intervention to support heart health is the inclusion of herbal protein bars in daily nutrition.

1. Low in Saturated Fat and Cholesterol-Free  
Traditional protein supplements and processed foods often contain high amounts of saturated fats and cholesterol, which can increase the risk of heart diseases. In contrast, herbal protein bars are formulated using plant-based proteins and healthy fats derived from sources like peanuts, flaxseeds, chia seeds, and coconut oil. These ingredients contain unsaturated fatty acids (omega-3 and omega6), which help in lowering LDL (bad cholesterol) levels and maintaining HDL (good cholesterol) in the blood. By replacing unhealthy fats with heart-friendly plant oils, herbal protein bars reduce the risk of plaque formation

in arteries, thereby preventing conditions such as atherosclerosis, coronary artery disease, and stroke.

2. Presence of Omega-3 and Omega-6 Fatty Acids Seeds such as pumpkin seed, often used in herbal protein bars, are rich in essential fatty acids. Omega-3 fatty acids play a crucial role in: Reducing triglyceride levels, Preventing blood clot formation, Lowering inflammation in arterial walls, Improving overall blood vessel flexibility. Regular consumption of omega-rich foods like herbal protein bars helps improve heart rhythm, reduce blood pressure, and decrease the risk of heart attacks.

3. Rich in Dietary Fiber Herbal protein bars contain significant amounts of soluble and insoluble fiber from ingredients such as chickpeas, and date paste. Soluble fiber binds with cholesterol particles in the digestive system and removes them from the body before they enter the bloodstream. This mechanism effectively reduces total cholesterol and LDL levels, promoting a healthy lipid profile. Additionally, fiber aids in maintaining healthy body weight and improving digestion — both of which are vital factors for cardiovascular well-being.

4. Antioxidant and Anti-Inflammatory Effects One of the major causes of heart disease is oxidative stress and inflammation in blood vessels. Herbal protein bars are rich in antioxidants such as flavonoids, polyphenols, and vitamins C and E, obtained from herbal ingredients like, ashwagandha, . Ashwagandha helps

- Taxonomy of Herbal Material

#### 1. Ashwagandha

Rank	Taxon
Genus	<i>Withania</i>
Species	<i>Withania somnifera</i> (L.) Dunal
Uses	Reducing stress, anti-inflammatory, neuroprotective.

#### 2. Chickpea

Rank	Taxon
Kingdom	Plantae
Division	Magnoliophyta (Flowering plants)
Class	Magnoliopsida (Dicotyledons)
Family	Fabaceae (Leguminosae / Pea family)
Genus	<i>Cicer</i>
Species	<i>Cicer arietinum</i> L.

in managing stress hormones (cortisol), which indirectly lowers blood pressure and heart strain. By minimizing oxidative stress and inflammation, these herbal compounds protect heart tissues and blood vessels from long-term damage.

5. Regulation of Blood Pressure High blood pressure is a leading risk factor for cardiovascular disease. Herbal protein bars contribute to blood pressure regulation in multiple ways: The magnesium and potassium present in seeds and nuts help relax blood vessel walls and improve circulation. The fiber and antioxidants aid in maintaining normal endothelial (vessel lining) function. Herbs like astragalus and ashwagandha act as adaptogens, helping the body adapt to stress and preventing blood pressure spikes. As a result, regular intake of herbal protein bars as part of a balanced diet can support stable blood pressure and prevent hypertension-related complications.

6. Weight Management and Heart Health Excess body weight increases the risk of cardiovascular diseases by raising cholesterol levels, blood pressure, and insulin resistance. Herbal protein bars, being rich in protein and fiber, promote satiety (fullness) and prevent overeating. This helps in: Controlling calorie intake, Managing body weight, Reducing fat accumulation, and Improving lipid metabolism. Maintaining a healthy weight through nutrient-rich snacks like herbal protein bars reduces overall cardiovascular strain and enhances heart efficiency.

Common Name	Chickpea, Bengal gram, Garbanzo bean, Chana.
Uses	Inflammation reduction, blood sugar control, high protein.

#### Functional Properties of Ingredients in Herbal Protein Bar

Ingredients	Antioxidant Activity	Anti-inflammatory Activity	Cardioprotective Effects
Watermelon Seed Powder	Contains phenolic compounds and vitamin E	May reduce oxidative inflammation	Rich in magnesium, helps regulate blood pressure
Soybean Powder	Contains isoflavones and saponins	Inhibits inflammatory enzyme	Reduces LDL cholesterol and improves lipid profile
Nuts Powder (Almonds/Walnuts)	Rich in vitamin E and polyphenols	Contains antiinflammatory fatty acids	High in omega-3s, supports heart function
Chickpea Powder	Moderate antioxidant content	High fiber reduces inflammation markers	Fiber and protein support heart health and weight control
Sesame Seeds	Contains sesamin and sesamol		Supports lipid metabolism and reduces atherosclerosis risk
Dark Chocolate	Rich in flavonoids and theobromine	Reduces inflammation via cytokine inhibition	Improves vascular health and reduces oxidative stress
Ashwagandha Powder	Contains withanolides with strong antioxidant action	Reduces levels of Creactive protein and cytokines	Improves heart function by reducing stress and maintaining cholesterol balance
PUMKIN SEED	Contains antioxidants	Reduce Inflammation	Rice in antioxidant, fibers, magnesium and phytosterol

### III. AIM AND OBJECTIVES

#### Aim

To design and analyze a herbal protein bar from plant-based ingredients that provide cardio protective, antioxidant, and anti-inflammatory effects.

#### Objectives

1. To choose natural ingredients high in plant protein and with recognized functional health attributes.
2. To formulate a stable, wholesome, and acceptable protein bar mix using herbal and functional food ingredients.
3. To analyze the formulated bar for its nutritional value, sensory characteristics, and functional

properties (such as antioxidant and anti-inflammatory activity).

4. To determine the acceptability, stability, and safety of the final product for consumption as a daily health supplement.

#### Ingredients and Materials Used

The herbal protein bar was formulated using the following plant-based and functional ingredients:

Ingredient	Primary Functional Properties
Watermelon Seed Powder	Packed with plant protein, magnesium, and omega-6 fatty acids; promotes heart health.
Soybean Powder	Whole plant protein source; has cholesterol-lowering and anti-inflammatory properties.
Nuts Powder (Almonds, Pistachio, Walnuts)	Supply essential fatty acids, antioxidants, and micronutrients; guard against heart disease.
Chickpea Powder	Supplements dietary fiber and plant protein; enhances digestion and inflammation reduction.
Ashwagandha Powder	Anti-inflammatory and neuroprotective properties; studies explore its effects on stress, anxiety, and neurodegenerative disorders.
Pumpkin Seed	Packed with plant protein; rich in antioxidants, improves heart health, blood sugar levels, fertility, and sleep quality; protects against certain types of cancer.
Peanut	Rich source of protein, fiber, antioxidants, and healthy fats; supports heart health by lowering bad cholesterol, aiding in weight management, regulating blood sugar, and providing nutrients for brain and digestive health.
Sesame Seeds	Rich in lignans and healthy fats to lower blood pressure and oxidative stress.
Dark Chocolate	High in flavonoids; contributes antioxidant activity and flavor.
Jaggery	Serves as a natural sweetener and source of energy.
Dates	Used as a natural sweetener and binder.

Table no 1 Ingredients and Materials

#### Formulation Procedure (Method)

The herbal protein bar was prepared through a series of steps:

1. Collection of Ingredients: All natural and herbal ingredients were collected.
2. Cleaning and Drying: Seeds, nuts, and legumes were cleaned and dried in sunlight or an oven to remove excess moisture.
3. Roasting: Peanuts, sesame seeds, and watermelon seeds were lightly roasted for 5–7 minutes to enhance flavor, aroma, and shelf life.
4. Grinding: Roasted ingredients were ground into fine or coarse powder. Dates and jaggery were ground into a thick paste to act as a natural sweetener and binder.
5. Mixing / Blending: All dry ingredients (powders and ashwagandha) were mixed. The dates/jaggery paste and melted dark chocolate were added slowly and blended until a uniform, sticky dough formed.
6. Shaping / Molding: The mixture was transferred to a lined tray or mold, flattened evenly, and manually shaped into bars or cubes.
7. Cooling and Setting: The molded mixture was refrigerated for 1–2 hours to set, then cut into equal-sized bars.
8. Packaging and Storage: Each bar was wrapped in food-grade film and stored in a cool, dry place or refrigerator.

## IV. EVALUATION PARAMETERS AND RESULTS

### 1. Physiochemical Parameters

Test	Procedure Summary	Observation / Result
pH Test	Crushed sample mixed with distilled water, filtered, and measured with a pH meter.	The pH value was 6.4, which is slightly acidic and within an acceptable range.
Moisture Test	Sample weighed, dried in a hot air oven at 105°C for 2 hours, cooled in a desiccator, and reweighed until constant weight.	Moisture Content was 1.75%. (Weight before drying W1=5.15g, Weight after drying W2=5.06g) .

Oil Content Test (Grease Spot Test)	A piece of the bar was rubbed on filter paper.	Oil mark present on the tissue (positive test for fat).
Protein Test (Biuret Test)	Sample filtrate was mixed with 10% Sodium Hydroxide (NaOH) and 1% Copper Sulfate (CuSO <sub>4</sub> ) solution.	Violet and purple color appeared (Positive test for protein).

Table no. 2 Physiochemical Parameters

## 2. Organoleptic (Sensory) Test

Parameter	Observation/Result
Taste	Mildly sweet, nutty.
Aroma	Chocolate and nuts aroma. Pleasantness of herbal and chocolate aroma.
Texture	Chewy and soft. Smoothness, chewiness, and crunchiness.
Color	Dark Brown. Uniform appealing brown.
Overall Acceptability	High acceptable.

Table no. 3 Physiochemical Parameters

## 3. Functional Properties

- Antioxidant Activity: Determined by the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging assay. Pumpkin seed, cocoa, and dark chocolate made notable contributions to this activity.
- Anti-inflammatory Potential: Substantiated from literature on constituents that suppress inflammatory markers, such as sesame lignans and dark chocolate flavonoids.
- Cardioprotective Relevance: Due to the composition of:
  - Omega-3 fatty acids (from nuts and seeds).
  - Plant sterols and flavonoids (from dark chocolate, sesame).

- Magnesium and fiber (from chickpea, soybean, and watermelon seeds).
- These assist in lowering LDL cholesterol, enhancing blood flow, and ensuring heart health.

## 4. Nutritional Content (Estimated Value per 50g Bar)

Nutrient	Estimated Value per 50g Bar
Energy	180–200 kcal
Protein	10–12 g
Fat	8–10 g
Carbohydrate	4–5 g
Antioxidant	Rich (polyphenols, flavonoids).

Table no.4 Nutritional Content (Estimated Value per 50g Bar)

## 5. Stability Results (Unpackaged Sample)

Day	Appearance	Odour	Texture	Remark
0	Normal	Pleasant	Firm	Acceptable
7	Slightly Dull	Neutral	Slightly Soft	Still Acceptable
15	Visible Fungal Spots	Unpleasant	Sticky	Spoiled
Visible fungal growth and a sour smell were observed after 12–15 days, and microbial spoilage was observed.				

Table no.5 Stability

## Summary of Results

The herbal protein bar formulated from plant-based functional ingredients (such as watermelon seed powder, soybean powder, nuts, chickpea powder, ashwagandha, pumpkin seeds, sesame seeds, dark

chocolate, jaggery, and dates) was successfully prepared and evaluated for its nutritional, sensory, and functional properties.

### 1. Physiochemical Evaluation

- pH: 6.4 (slightly acidic; acceptable for consumption)
- Moisture Content: 1.75% (indicates good shelf stability)
- Oil Content: Positive (presence of healthy fats from nuts and seeds)
- Protein Test: Positive (violet color in Biuret test confirms protein presence)

### 2. Organoleptic (Sensory) Evaluation

- Taste: Mildly sweet and nutty
- Aroma: Pleasant chocolate–nut aroma
- Texture: Soft, chewy, and mildly crunchy
- Color: Dark brown, uniform
- Overall Acceptability: High

### 3. Functional Properties

- Antioxidant Activity: High due to pumpkin seeds, sesame, cocoa, and dark chocolate
- Anti-inflammatory Potential: Present, supported by ashwagandha, sesame lignans, and flavonoids

- Cardioprotective Benefits: Ingredients such as nuts, seeds, soybean, and dark chocolate contribute to LDL reduction, improved circulation, and heart health

### 4. Estimated Nutritional Value (Per 50g Bar)

- Energy: 180–200 kcal
- Protein: 10–12 g
- Fat: 8–10 g
- Carbohydrates: 4–5 g
- Antioxidants: Rich in polyphenols and flavonoids

### 5. Stability Study (Unpackaged Bar)

- Day 0: Normal appearance, pleasant odor, firm texture
- Day 7: Slight dullness; texture slightly soft but acceptable
- Day 15: Visible fungal spots, unpleasant odor, sticky texture → Spoiled
- Shelf-life without packaging: ~10–12 days

### Testing Result Images



## V. FUTURE PROSPECTS AND CONCLUSION

### Future Prospects

The prospects are bright due to the global shift toward health-conscious, plant-based, and sustainable food choices. The bar is a convenient and effective solution for daily nutrition, catering to the demand for clean-label products and preventive healthcare. Continuous research is expected to lead to bars enriched with bioactive compounds, superfoods, and therapeutic herbs, offering targeted health benefits.

### Conclusion

The Herbal Protein Bar is a nutrient-rich, natural, and health-promoting food product formulated using plant-based and herbal ingredients. It is an excellent source of protein, essential fatty acids, vitamins, and minerals. It provides therapeutic benefits such as antioxidant, anti-inflammatory, and immune-boosting effects, and offers a convenient, safe, and chemical-free alternative to commercial protein supplements.

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