Development of Ayurvedic Nutraceutical Immunity Booster Biscuit

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Abstract- Background: The decline in the number of COVID-19 does not return people's conditions to the period before the pandemic. Efforts to prevent the spread of the coronavirus are still being carried out by implementing health protocol and keeping the body's immunity in top shape, one of which is by consuming balanced nutrious foods high in antioxidants. This research focuses on the development of a herbal immunity booster biscuit incorporating health promoting ingredient such as Ashwagandha, Tulsi, Moringa powder, Oats, Jaggery, Homemade Ghee. The primary objective is to formulate a functional snack that offer s high nutritional value with a low glycemic index, suitable for health-conscious individuals and diabetic patients. Each ingredient was selected based on its individual health benefits. The final product aims to balance health and palatability while contributing to the growing demand for nutraceutical and functional food products. Stress and fast life is major cause of many diseases. *Withania somnifera* is herb rich in micronutrient which reduce stress and depression. The aim of present study is to formulate ayurvedic biscuit which enriched with *Withania somnifera* and Moringa oleifera herb. The value added biscuits samples were prepared in four different ratio and combination: W0, WC1, WC2 and WC3. Each experiment was replicated five times. The sensory value was determined by 9-point hedonic scale of 10 panel judges expert in food technology. Nutritional and proximate value were determined by AOAC method (2010). All data were statistically analyzed using standard deviation techniques. The sensory value of different biscuits reflects.

Keywords: Nutraceutical Biscuit *Withania somnifera* (Ashwagandha), Moringa oleifera, Herbal Immunity Booster, Functional Food.

I.INTRODUCTION

The reduction in the number of COVID-19 cases did not necessarily restore the condition of society to the pre-pandemic period. Efforts to prevent the spread of coronavirus are still being carried out by implementing health protocols to break the virus's transmission chain. Educational efforts must continue to address the importance of increasing body resistance (Sumarmi, 2020). A good immune system is the body's defense force against disease-causing organisms, such as bacteria and viruses (Kementerian Kesehatan, 2020).

Maintaining normal body weight and consuming various nutritious foods are the principles for increasing body immunity. In the body, various nutrients, including macronutrients and micronutrients, work together to protect the body from various pathogen attacks that cause infection (Sumarmi, 2020). Sun et al. (2020) showed that proteins could play a role in boosting the body's immune system because of their function as a form of immunoglobulin. (Ig). The body forms IgM and IgG immunoglobulins to disrupt the SARS-Cov 2 virus. In addition to proteins, the body requires polyunsaturated fatty acids to boost the immune system and suppress inflammation caused by infections. Research has shown the role of double unsaturated fatty acids in the treatment of inflammation (Weylandt *et al*., 2015).

In recent years, there has been an increasing consumer demand for functional foods that not only satisfy hunger but also provide health benefits beyond basic nutrition. Biscuits, being a widely consumed snack, present an excellent platform for fortification with health-enhancing ingredients. Bajra (Pennisetum glaucum), agar, sugar-free sweeteners, milk powder, and custard powder. Each of these components has been traditionally used in various cuisines and herbal remedies, and collectively they offer a wide spectrum of nutritional benefits. The aim of this formulation is to deliver a high-protein, high-fiber, low-sugar biscuit

that supports digestive health, heart health, and glycemic control. This research not only focuses on the nutritional profiling and health benefits of the ingredients but also evaluates the organoleptic properties and consumer acceptability of the final product. Our Ayurvedic Nutrient Biscuit is a wholesome and health-focused snack biscuit, thoughtfully crafted using a blend of nutritious ingredients. The addition of milk powder and custard powder enhances its creamy texture and taste, while agar provides a natural gelling agent to support digestive health. This biscuit is a guilt-free delight suitable for health-conscious individuals and diabetics alike. A perfect fusion of tradition and wellness, this biscuit is ideal for those seeking a balanced and nourishing snack.

Nutraceuticals are food products considered as pharmaceutical alternatives with physiological or medicinal benefits, which help improve body functions, prevent various health conditions, increase life expectancy, maintain body cell integrity, as well as support body structure. Consumed by a good range of population due to low moisture content and free from microbial spoilage, their varied taste, long period, and comparatively low cost. The oats used for the assembly of biscuits is deficient in several nutrients including some vitamins, mineral elements, also dietary fiber. Due to competition within the market and increased demand for healthy, natural, and functional products, attempts are being made to enhance the nutritive value of biscuits and functionality by modifying their nutritive composition. Herbs are therapeutic plants that contain substances that actively hinder the growth of microorganisms, hence reducing or eliminating health problems. Because of their nutritious value, flavour, compactness, and convenience, biscuits are perfect. Biscuits often have a longer shelf life and are more resistant to microbial decomposition than cakes and bread because they contain less moisture. In terms of baked goods worldwide, biscuits comprise the greatest category of nutrient-dense snack foods. Because they portable, have a longer shelf life, taste good, and are cheaply priced, biscuits are becoming a popular ready-to-eat product for all age groups. Biscuits consist of three major components: Oats, Ashwagandha, Moringa. The present investigation was planned to develop to develop a product with high fiber content and low caloric value.

MATERIAL AND METHOD

1. Oats
2. Ashwagandha
3. Moringa
4. Tulsi
5. Jaggery
6. Cow milk
7. Dry fruits
8. Ghee

1.OATS

Oats has been recognized as a valuable foodstuff since ancient times, due to its nutritional attributes. This cereal provides important amounts of carbohydrates, mainly in the form of starch, dietary soluble fiber, lipids, good-balanced proteins and several B vitamins. Recently, oat has received increased attention due to its health-related benefits. Consumption of oat products has been associated to reduction of serum cholesterol, and the risk of cardiovascular diseases (CVD), as well as with prevention of cancer, diabetes and gastrointestinal disorders [1]. Based on clinical studies, the U. S Food and Drug Administration and European Food and Safety Agency have approved health claims for oat-derived foods regarding the ability of oat β-glucan (OBG) to reduce the serum cholesterol and the risk of CVD [2,3]. However, the beneficial effects of oat consumption have been attributed not only to the presence of OBG but also to other bioactive compounds [1].

The inclusion of oat in gluten-free diets may improve the nutritional status of celiac people and can offer a wider choice in their diets. Nowadays the food industry is investing a great deal of effort in increasing the usage of oat as ingredient for formulating novel food products. The information provided in this review is based on very recent literature sources.

Figure no 1

Figure no. 2

2.ASHWAGANDHA

Ashwagandha (*Withania Somnifera*) or Gandhpatri or Asgandha is a value based herb which has been used by human for more than 3,000 years and it is the oldest medicinal systems in the Ayurvedic medicine. Ashwagandha is commonly found in all parts of India from the northern tropics to southern India. The leaves and roots of Ashwagandha are mainly used for medicine and good source of dietary fiber (28.8%) and minerals (10.1%) apart from having with aferine A content of 0.16% .

Roots of Ashwagandha having many biochemical heterogeneous alkaloids, is full of nutrients such as withanolids, acyl steryl glucosides, anferine, iron, lactones, nitrate, potassium, somniferine, sominine.

Ashwagandha, also known as Indian ginseng has health benefits which are as follows such as it controls cholesterol levels, treats erectile dysfunction, increases fertility in men, reduces anxiety, relieves stress, fights diabetes, controls hair fall and hinders, treat osteoporosis and rheumatic arthritis, treats cancer, stimulates the thyroid gland, boosts immunity, increases blood production, prevents seizures, aids in muscle growth, reduces ocular diseases, anti-tumour, anti-inflammatory and antibacterial properties. Ashwagandha is composed of several nutrients like glycowithanolides (antioxidants), potassium nitrate, iron, fatty acids, tannins, glucose, alkaloids and numerous other substances, as these compositions are rich sources of Ashwagandha.

3.MORINGA

Moringa (Moringa Oleifera) is a rich source of proteins, minerals, vitamins and antioxidants with a relatively low amount of anti-nutritional factors. It is considered as a multipurpose tree which has great potential. It has been reported that this tree can help improve food security and reduce malnutrition (Domenico et al., 2018). Moringa leaves powder has been used in preparation of Biscuit using fine flour (Dachana et al., 2010). The aim of the current study was to enrich whole wheat flour biscuits using moringa leaves powder. The Moringa oleifera tree is universally known as a miracle plant. This plant derived its name from the fact that all its parts (leaves, seeds, flowers etc.) can be used as nutritional supplement, medicine, water purifier and animal fodder (Daba, 2016). (Moringaceae) is now cultivated in many subtropical regions in Africa, tropical America, Mexico, Malaysia, and the Philippines. Several studies have shown that Moringa oleifera leaves are a rich source of certain macro and micronutrients. Sánchez-Machado et al. (2010) reported that Moringa plant contains a high percentage of essential amino acids in green leaves.

The leaves of Moringa have also been found to contain important amounts of calcium, potassium, magnesium, vitamin A, C and E (Hekmat et al., 2015). Currently, the use of Moringa oleifera as a nutrient-rich plant for food supplementation is getting much attention.

Figure 3

4.TULSI

Tulsi (Ocimum sanctum Linn. / Ocimum tenuiflorum, Family: Lamiaceae), commonly known as Holy Basil, is a well-recognized medicinal herb widely used in traditional Indian systems of medicine such as Ayurveda. It is valued for its adaptogenic, immunomodulatory, antimicrobial, and antioxidant properties, making it a promising functional ingredient for nutraceutical and fortified food products, including herbal biscuits. Tulsi leaves contain several bioactive phytoconstituents such as eugenol, ursolic acid, rosmarinic acid, flavonoids, tannins, and essential oils, which contribute to its therapeutic effects. These compounds exhibit antioxidant and free-radical scavenging activity, helping to reduce oxidative stress and support immune function. The antimicrobial properties of Tulsi also assist in improving product safety and shelf life by inhibiting microbial growth.

In bakery applications, Tulsi leaf powder or extract can be incorporated as a functional additive to enhance the health value of biscuits. It provides benefits such as:Immune boosting activity, Anti-inflammatory effects, Respiratory support, Antimicrobial protection, Natural preservation. Added nutraceutical valueFrom a formulation perspective, Tulsi powder can be added at low concentrations (generally 1–3%) to avoid strong bitterness while maintaining acceptable sensory properties (taste, aroma, color, and texture). Thus, Tulsi serves as a natural, safe, and cost-effective herbal ingredient for the development of functional herbal biscuits aimed at promoting health.

Figure 4

5.JAGGERY

Jaggery is a traditional, unrefined natural sweetener obtained from sugarcane juice or palm sap through concentration and solidification without chemical refining. Unlike refined sugar, jaggery retains significant amounts of minerals, vitamins, and bioactive compounds, making it a nutritionally superior alternative for functional and herbal food products.Chemically, jaggery mainly consists of sucrose (60–85%), along with reducing sugars (glucose and fructose), proteins, small amounts of fats, and moisture. It is also rich in essential minerals such as iron, calcium, magnesium, potassium, and phosphorus, and contains phenolic compounds with antioxidant activity. These constituents contribute to its nutraceutical and health-promoting properties.

Jaggery exhibits several biological benefits, including: Natural energy source, Antioxidant activity, Iron supplementation and anemia prevention, Digestive aid, Detoxifying effect, Immunity enhancement.In bakery and biscuit formulations, jaggery serves both functional and technological roles. It acts as a natural sweetener, color enhancer, and flavoring agent, imparting a characteristic caramel-like taste and desirable brown color. Its hygroscopic nature helps improve moisture retention, texture softness, and mouthfeel of biscuits. Additionally, its mineral content enhances the overall nutritional value of the product compared to refined sugar-based biscuits.

Figure 5

6.COW MILK

Cow milk is a highly nutritious dairy ingredient widely used in bakery and functional food formulations due to its balanced composition of proteins, carbohydrates, fats, vitamins, and minerals. It serves both nutritional and technological functions in biscuit production and contributes to improved texture, flavor, and overall product quality.Cow milk primarily consists of water (≈87%), lactose (4.5–5%), proteins (3–3.5%), milk fat (3–4%), and minerals (0.7%). The major proteins include casein and whey proteins, which are known for their high biological value and excellent digestibility. It also provides essential micronutrients such as calcium, phosphorus, potassium, vitamin A, vitamin D, and B-complex vitamins, which enhance the nutritional profile of fortified or herbal food products. Functionally, cow milk offers several benefits in biscuit formulation:

Improves protein content and nutritional quality, Enhances dough cohesiveness and structure,

Contributes to desirable flavor and aroma, Promotes browning through Maillard reaction, Improves texture, softness, and mouthfeel, Increases mineral enrichment (especially calcium).

In herbal biscuit development, milk can be incorporated as liquid milk or milk powder. Milk solids interact with flour proteins and herbal ingredients, improving dough handling properties and baking performance. Lactose and proteins participate in Maillard browning during baking, resulting in enhanced color development and sensory acceptability. Additionally, milk complements herbal ingredients by reducing bitterness and improving palatability.

Figure 6

7.DRY FRUITS

Dry fruits are dehydrated natural products obtained from fresh fruits and nuts with reduced moisture content, resulting in enhanced shelf life, concentrated nutrients, and improved storage stability. Due to their rich nutritional profile and functional properties, dry fruits are widely incorporated into bakery and nutraceutical food products, including herbal biscuits, to enhance both health benefits and sensory quality. Dry fruits such as almonds, cashews, raisins, dates, figs, and pistachios are excellent sources of proteins, dietary fiber, healthy fats (mono- and polyunsaturated fatty acids), natural sugars, vitamins, and minerals. They are particularly rich in iron, calcium, potassium, magnesium, zinc, vitamin E, and B-complex vitamins, along with bioactive compounds such as polyphenols, flavonoids, and antioxidants. These constituents contribute to their therapeutic and health-promoting properties.The major functional benefits of dry fruits include: High energy value and sustained energy release, Antioxidant and free radical scavenging activity, Cardioprotective effects, Improved digestive health due to fiber content, Micronutrient supplementation, Immune system support.

Thus, dry fruits serve as natural, nutrient-dense, and functional ingredients, making them highly suitable for the development of fortified herbal biscuits with

enhanced health benefits, improved sensory acceptance, and added market value.

Figure 7

8.GHEE

Ghee, commonly known as clarified butter, is a traditional dairy fat obtained by heating butter to remove water and milk solids, resulting in a pure, shelf-stable lipid fraction. It has been widely used in traditional Indian foods and Ayurvedic preparations due to its nutritional value, stability, and therapeutic properties, making it a suitable functional ingredient for herbal and nutraceutical bakery products such as biscuits.

Chemically, ghee consists predominantly of milk fat (≈99–99.5%), composed of saturated fatty acids, monounsaturated fatty acids, short- and medium-chain fatty acids, and small amounts of phospholipids. It also contains fat-soluble vitamins (A, D, E, and K) and natural antioxidants such as conjugated linoleic acid (CLA) and butyric acid, which contribute to its health-promoting effects.In biscuit formulations, ghee performs important technological functions. It acts as a shortening agent that coats flour particles, limiting gluten development and producing a tender, crisp, and flaky texture. It improves dough plasticity, spread ratio, mouthfeel, and flavor, while also contributing to desirable golden-brown color during baking. Its low moisture content enhances shelf stability and oxidative stability compared to other fats or oils. Thus, ghee serves as a stable, nutrient-rich, and sensory-enhancing fat source, making it highly suitable for the development of functional herbal biscuits with improved texture, flavor, and nutritional quality.

Figure 8

II.INGREDIENTS TABLE

Table no: 1 RAW MATERIAL INGREDIENTS AND COST FOR 1KG BATCH

S.no.	Ingredient	Quantity	Rate
1.	Ashwagandha	50g	600/kg
2.	Moringa Powder	50g	500/kg
3.	Oats	50g	120/kg
4.	Tulsi Powder	20g	800/kg
5.	milk	200ml	60/lit.
6.	Ghee	120g	800/kg
7.	Cocoa Powder	50g	400/kg
8	Jaggery	50g	80/kg
9.	Baking Soda	10g	100/kg

III.METHOD

PHASE 1: Preparation & Dry Mix-

1. Mise en Place: - Weigh all ingredients accurately. Sift the oat into the mixer grinder for fine powder then shift it into a bowl to remove lumps (if any present).

2. Combine Dry Ingredients:- Add the Ashwagandha, Tulsi, and Moringa powders along with the chopped dry fruits to the oat flour. Whisk until the herbs and fruits are uniformly distributed.

PHASE 2: Wet Mixture

3. Dissolve Jaggery:- In a small saucepan, heat the milk and jaggery over low heat until the Jaggery is completely melted.

4. Emulsify:- Remove from heat and allow to cool slightly. Whisk in the Ghee until the mixture is smooth and well combined.

PHASE 3: Dough Formation

5. Incorporate: Gradually pour the wet the mixture into the dry ingredients.

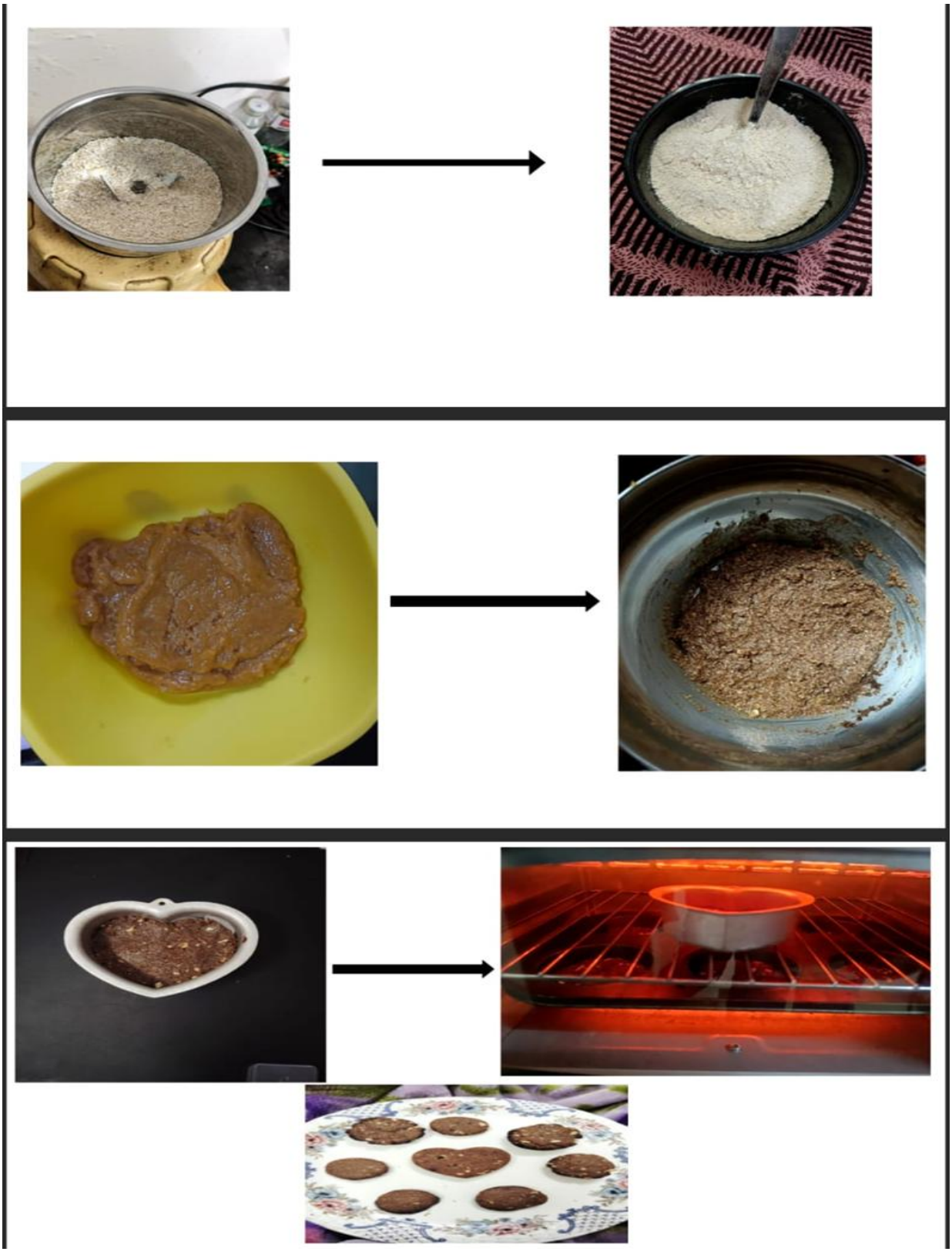
6. Knead & Rest:- Gently knead the mixture until the cohesive dough forms. Cover and let the dough rest for 30 minutes to allow the oat flour to hydrate.

PHASE 4: Baking & Storage

7. Shape & Bake:- Preheat the oven to 180°C. Shape the dough into uniform biscuit round and place them on baking tray. Bake for 15-20 minutes for until firm.

8. Cooling:- Transfer the biscuits to a wire rack. Once completely cooled, store them in a air tight container to maintain the freshness.

IV.PROCEDURE



V.EVALUVATION PARAMETER

Table no 2

S. No	Test Name	Purpose / Claim Supported	Principle	Expected Result (Herbal Biscuit Extract)	Reference / Acceptable Activity
1	DPPH Radical Scavenging Assay	Antioxidant	Reduction of DPPH free radical	40–80% inhibition	>30% considered active
2	ABTS Radical Scavenging Assay	Antioxidant	ABTS•+ radical decolorization	50–85% inhibition	>40% good activity
3	FRAP Assay	Reducing power	Ferric to ferrous reduction	200–800 µmol Fe^{2+}/g	Higher value = stronger activity
4	Total Phenolic Content (TPC)	Antioxidant marker	Folin–Ciocalteu method	50–250 mg GAE/100g	Higher phenolics desirable
5	Total Flavonoid Content (TFC)	Antioxidant marker	Aluminium chloride method	20–150 mg QE/100g	Higher value better
6	Nitric Oxide Scavenging Assay	Anti-inflammatory	Inhibition of NO radicals	≥40% inhibition	>30% significant
7	Protein Denaturation Inhibition	Anti-inflammatory	Prevention of protein denaturation	≥40% inhibition	>30% active
8	α-Amylase Inhibition Assay	Anti-diabetic	Inhibition of starch breakdown	20–60% inhibition	>20% effective
9	α-Glucosidase Inhibition	Anti-diabetic	Inhibition of glucose release	25–70% inhibition	>25% good activity
10	Lipid Peroxidation (TBARS)	Antioxidant	Inhibition of MDA formation	30–70% inhibition	Higher % better
11	Cytotoxicity (MTT Assay)	Safety screening	Cell viability measurement	≥80% cell viability	>70% safe
12	Glycation Inhibition Assay	Anti-aging/anti-diabetic	Inhibition of AGE formation	≥30% inhibition	>25% significant

VI.CONCLUSION

The nutraceutical herbal biscuit prepared using moringa, ashwagandha, oats, jaggery, ghee, milk, and dry fruits was successfully developed with good nutritional and functional properties. The product showed acceptable physicochemical, microbiological, and sensory characteristics. The presence of moringa and ashwagandha enhances antioxidant and health-promoting benefits, making it a healthy alternative to conventional biscuits.The formulation complies with general food safety requirements under Food Safety and Standards Authority of India guidelines and has potential for commercial development as a functional nutraceutical snack.

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