

Role of Prebiotic for Better Health

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Abstract

The research aims to develop prebiotic based novel food product which can benefit in the prevention of gastro intestinal disorder as well as its symptoms like acidity with ingredients that have high fiber, antimicrobial and antioxidant action. High-fiber foods such as fruits, vegetables, and grains diminish acid reflux due primarily. Fiber aid in digestion, retain fluid within the digestive framework, preventing the displacement of stomach corrosive. Hence, sources of dissolvable fiber, such as sunflower seeds are particularly advantageous decreasing aggravation and other absorption related issues and on the other hand, the insoluble fiber present in flax seed can offer assistance to relieve or avoid obstruction and keep ones bowel developments normal. Little amounts of lemon when added to water can have an alkalizing effect on the digestive tract. It can help to obstruct the acidity created by GERD and acid reflux. Ginger makes a difference in acid reflux, which could be an extraordinary way to treat this condition actually, without any medicine. Besides, it also includes additional nutrition to your everyday slim down. The novel nourishment product was developed with mint flavors. Prebiotics play a crucial role in promoting better health by fostering the growth and activity of beneficial microorganisms in the gut. These non-digestible fibers and compounds serve as a source of nutrition for probiotic bacteria, which are the beneficial bacteria residing in the gastrointestinal tract. The symbiotic relationship between prebiotics and probiotics contributes to various aspects of overall well-being.

Keywords: Sunflower Seeds, Flax Seed, GERD (Gastro-Oesophageal Reflux Disease), Dietary Fibre.

Introduction

Prebiotic has been defined as “a non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improves host health”. Certain compounds belonging to carbohydrate group such as short and long chain β -fructans [FOS and inulin], lactulose, and GOS, can be categorized as prebiotics. In the year 2008, during the 6th Meeting of the International Scientific Association of Probiotics and Prebiotics (ISAPP) defined “dietary prebiotics” as “a selectively fermented ingredient that results in specific changes in the composition and/or activity of the gastrointestinal microbiota, thus conferring benefits upon the host health” (Gibson G.R et al., 2010).

The dietary fibres of prebiotic have more importance in shaping of gut micro biotic compounds which function as a carbon source for the growth of most beneficial taxa, and thus delivering certain changes which confers the host health related to its metabolism. Prebiotics plays an important role in human health. In nature, it exists in different

dietary food products, such as asparagus, sugar beet, garlic, chicory, onion, Jerusalem artichoke, wheat, honey, banana, barley, tomato, rye, soybean, human's and cow's milk, peas, beans, etc., and recently, seaweeds and microalgae (Varzakas T et al., 2018).

Research on prebiotic dietary fiber has found that although changes in specific gastrointestinal (GI) taxa are often connected with health, but this effect alone is not considered a direct health benefit under most conditions. Prebiotics can selectively impact gut microbiota, which affects the intestinal functions, such as metabolism and integrity of the intestine. Moreover, they can suppress pathogens in healthy individuals through initiation of some immunomodulatory molecules with antagonists' effects against pathogens by lactic acid that is produced by *Bifidobacterium* and *Lactobacillus* genera (Shokari D et al., 2018).

Different types of microorganisms, known as gut microbiota, are occupant of the human gastrointestinal tract where it has been reported that there are 10^{10} - 10^{12} live microorganisms per gram in the human colon. These resident microbial groups in the stomach, small, large intestine are crucial for human health. The majority of these microorganisms, are mostly anaerobes and live in the large intestine (Louis P et al., 2016).

Gut microbiota” mention to the trillions of microscopic organisms that live in your gastrointestinal (GI) tract and make up your gut microbiome. Generally, large intestine is home to the majority of these microorganisms. They carry out functions that are essential to overall health, including nutrient metabolism and regulation of the immune system. Your gut microbiota can even influence disease risk, including the risk of developing colon cancer, inflammatory bowel disease, and type 2 diabetes. Prebiotics are essential to a healthy microbiome. In simple terms, they're nutrients that get broken down by gut bacteria. Bacteria in the large intestine ferment prebiotics. This releases by-product called short-chain fatty acids. These by-products act as energy sources for the cells lining the colon, called colonocytes, and benefit health in many other ways. (Dorna Davani-Davari et al., 2019).

Nutritional ingredients, including various fibers, herbs, and botanicals, have been historically used for various ailments. Their everlasting appeal is forecast on the desire both for more natural approaches to health and to mitigate potential side effects of more mainstream treatments. Nutritional ingredients (a collective term used herein to describe botanicals, including dietary fibers, and non-botanicals) have been employed throughout history for a myriad of GI (Gastrointestinal) conditions and symptoms due to their claimed anti-ulcer, carminative, spasmolytic, soothing, and laxative effects, to name a few. The acceptance of these products continues to increase, as evidenced by sales growth of 8.6% in 2019, the second largest percentage increase since 1998. (Rebekah M. Schulzet al., 2022).

Examples of structural upper GI conditions include erosive esophagitis, gastritis, and peptic ulcer disease, sometimes associated with *Helicobacter pylori* (*H. pylori*) infection. Functional disorders involving the upper GI tract include GERD, esophageal hypersensitivity, esophageal dysmotility, and non-ulcer dyspepsia. Among these upper GI conditions, symptoms can include heartburn, reflux, indigestion, regurgitation, nausea, vomiting, trouble swallowing, upper abdominal fullness, bloating, loss of appetite, and epigastric pain. While some individuals may experience occasional symptoms of upper GI distress, which may differ only slightly from normal perceived baselines, other individuals may notice a consistent pattern of these symptoms, which can then be mapped to a defined DGBI (Disorders of gut–brain interaction) diagnosis. (Drossman, 2016).

There are some revised definitions of prebiotics published in the scientific literature, however the above-mentioned definition which was given in 2008, has been accepted in recent years. Despite the absence of a consensus definition, the important part of the original and other definitions is that the consumption of prebiotics is associated with human well-being. The word “selectivity”

or the potency of a prebiotic to stimulate a specific gut microbiota, was another key element of the original definition; however, this concept has been questioned recently (Bindels L.B et al., 2015). Some prebiotics are endogenous factors such as mucin secretions, can affect the microbial balance, human diet is the chief sources of energy for their growth. Particularly non digestible carbohydrate can highly alter the composition and function of gut microbiota (Walker A.W et al., 2011).

Review of Literature

The concept of functional foods was introduced in Japan during the 1980s, and it could be defined as “any food or ingredient that may provide a health benefit beyond the traditional functions hitherto known. Products claiming to be healthier and to have functional and/or health properties have gained importance in research, in the occurrence of new products and in supermarkets. Prebiotics are short chain carbohydrates that are non-digestible by digestive enzymes in humans and selectively enhance the activity of some groups of beneficial bacteria. In the intestine, prebiotics are fermented by beneficial bacteria to produce short chain fatty acids. Prebiotics also provide many other health benefits in the large intestine such as reduction of cancer risk and increase calcium and magnesium absorption.

Properties of Prebiotics

According to the International Scientific Association of Probiotics and Prebiotics, in order for a compound to be classified as a prebiotic, it should

- Resist stomach acid and digestive enzymes, and should not be absorbed in the GI tract
- Be able to be fermented by intestinal microbes
- Stimulate the growth or activity of intestinal bacteria to improve health (Dorna Davani-Davari et al., 2019)
- Support of the immune system
- It should be capable of inducing a physiological effect that is beneficial to health.
- Stimulation of the absorption and production of B vitamins (B1, B2, B3, B6, B9, B12)

There are many types of prebiotics. The majority of them are a subset of carbohydrate groups and are mostly oligosaccharide carbohydrates (OSCs). The relevant articles are mainly on OSCs, but there are also some pieces of evidence proving that prebiotics are not only carbohydrates.

Prebiotic as Functional Food

When prebiotics are incorporated into food products with the intention of providing health benefits beyond basic nutrition, they are often referred to as functional foods. Functional foods are those that offer additional health benefits beyond their basic nutritional content.

Sunflower Seeds

The seed and sprouts of the sunflower contain important nutrients such as antioxidant, antimicrobial, anti-inflammatory, antihypertensive, wound-healing, and cardiovascular benefits found in its phenolic compounds, flavonoids, polyunsaturated fatty acids, and vitamins. It is also utilized in ethnomedicine for treating various disease conditions such as heart disease, bronchial, laryngeal and pulmonary diseases, coughs and colds and in whooping cough (Bashir T et al., 2021). These notable medicinal, nutritional, and culinary benefits have brought about in authentic and developing popularity of the sunflower plant and its constituents world-wide. The health benefits of sunflower seeds/oils are credited to its major nutritional constituents which include high monounsaturated and polyunsaturated fats, proteins, tocopherols, phytosterols, copper, zinc, folate, iron and vitamin B possessing antimicrobial, antidiabetic, anti-inflammatory, antihypertensive, and antioxidants (Nandha, Singh, Garg, & Rani, 2014).

Flaxseeds

Flaxseeds serve as a good source of both soluble and insoluble dietary fiber. Flaxseed holds a unique place among the oilseeds due to presence of mucilage located in outer layers of the seed (Singh et al., 2012). The major bioactive compounds in flaxseed are alpha-linolenic acid (ALA), lignans and fiber. Four common types of flax seed are available for human utilization which incorporates entirety flaxseed, ground flaxseed, flaxseed oil and mostly defatted flaxseed meal (Parikh M et al., 2018). Generally, flax seeds are utilized to improve digestive wellbeing or diminish constipation. It can moreover support the development of beneficial microbes and heal numerous intestine issues. Subsequently, the control of the microbiome on human and animal health is getting increasing attention from the research community.

Lemon Citrus Peel (CP)

Lemon shows different characteristics, such as antimicrobial, antifungal, anti-inflammatory, anti-cancer, depurative, antiscorbutic, etc. The utilization of citric acid, in lemon juice, may effectively progress indigestion and can maintain an ideal intestinal environment because it helps or assist in gastric corrosive work. (Tadayuki Iida et al., 2021). It has also been noted that Citrus peel contain more amounts of these compounds than corresponding edible parts of the fruits. Phenolic compounds present in CP act as antioxidants (by either donation of protons or electrons) and protect cells against free radical damage as well as help in reducing the risk of many chronic diseases. Owing to the more abundance of polyphenols in CP's, their antioxidant activity is also higher than other edible fruit parts. Therefore, peels from citrus fruits can be used as sources of functional compounds and preservatives for the development of newer food products, that are not only safe but also have health-promoting activities. (Singh, Balwinder, et al., 2020). Citrus peel (CP) generally forms around 40–50% of the entire fruit mass, but it is usually thought to be a waste. However, it is significant source of naturally occurring health-intensifying compounds primarily phenolic compounds and carotenoids. Phenolic compounds in CP mainly comprised of phenolic acids (primarily caffeic, p-coumaric, ferulic and sinapic acid), flavanones (generally naringin and hesperidin) and polyethoxylated flavones (notably nobiletin and tangerine). Subsequently, peels from citrus fruits can be broadly used as sources of functional compounds and preservatives for the development of novel food products, which are not only secure but can also have health-promoting benefits. It is believed that ginger acts directly on the gastrointestinal system to minimize nausea. It is additionally used to prevent nausea resulting from chemotherapy, motion sickness, and surgery.

Ginger

Ginger plays a vital role as a cure for nausea during pregnancy. It is also used to treat distinctive types of GI problems such as morning sickness, colic, upset stomach, gas, bloating, acid reflux, flatulence, diarrhea, loss of appetite, and dyspepsia (discomfort after eating). Indian Ayurvedic medicinal system states that ginger is recommended to increase the process of digestion of food and has been proclaimed as a pain relief for joint pain, muscle soreness, chest pain, low back pain, stomach pain, and menstrual pain. Besides, it can also be utilized for treating upper respiratory tract infections, cough, and bronchitis. Active components of ginger are broadly accepted as a purgative and antacid medicine. It is also used to warm the body for elevating circulation and lowering high blood pressure. Due of its warming effect, ginger acts as antiviral for treatment of cold and flu. (P.Alam, 2013).

Objectives

The present study was undertaken with the following goals;

- Procurement and processing of prebiotic raw materials.
- Formulate and standardize flavored prebiotic product.
- Analyze the nutrient content of the developed prebiotic product.

Methodology

The Quantitative study comprises of procurement of the raw materials namely Sun flower seeds, flax seeds, lemon peel and dried ginger and mint for the development of flavored pre-biotic instant mix to combat Gastrointestinal Disorders. Development of flavored instant mix to combat Gastrointestinal Disorders and carry out, sensory evaluation of the developed product, using 9-point Hedonic scale. The raw materials were purchased from the local market of Tiruchirappalli district. Sunflower seeds 1kg, without any infestation or damage, was cleaned and washed. Allow to sundry for 2 days to remove moisture. Then the seeds were slightly roasted under slow flame until light color changes is seen and cooled at room temperature for 10 minutes. Then the roasted seeds were ground to powder. Around 50 Fresh lemon and 1 kg ginger were purchased from nearby super market. The lemon juice was extracted and stored in the refrigerator for further use but whereas, the leftover peel was used for the processing of raw material. Lemon peel and fresh ginger were sundried for 1 week (7 days) until color changes and complete dryness could be felt. It was then ground into fine powder by using blender and the powder was sieved by using flour sifter and finally the powder was added to the roasted seed powder. The prebiotic based raw material powder was stored in an air tight container for the development of product and further study.

Flow Chart for the Preparation of Mint Powder



Sundry, mint leaves for 3 – 4 days until the color turns dark



Grinding it well into the blender and sieved



Finally, adding the fine powder of mint with the prepared raw material powder

Ingredient Composition of Prebiotic based Mint Flavoured Instant Mix (100G)

The prebiotic based mint flavored instant mix were standardize in the ratio of 1:3, 2:2, 3:1 where the ratio of 3:1 gave better result during organoleptic evaluation where taste, flavor, color and overall acceptability which was evaluated by the staffs and students of Jamal Mohamed College, Trichy.

S. No.	Ingredients	T ₀ (Without Flavour)	T ₁ (1:3) (With Flavour)	T ₂ (2:2) (With Flavour)	T ₃ (3:1) (With Flavour)
01	Sunflower Seeds Powder	15g	10	20	30g
02	Flax Seed Powder	15g	30	20	10g
03	Lemon Peel Powder	25g	20g	20g	20g
04	Ginger Powder	25g	20g	20g	20g
05	Mint Powder (For Flavor)	20g	20g	20g	20g

Analysis of Nutrient Content of Developed Prebiotic Product

Nutritional analysis namely carbohydrate, protein, fat, fiber of the developed prebiotic product (without flavor) was analysed. The chemicals and reagents used in the study were analytical reagent (AR) The following chemicals namely Anthrone Reagent, Bradford’s reagent, Chloroform, Methanol, cholesterol, H₂SO₄, sulfo-phosphoric-vanillin acid agent, was used in this study. Estimation of Carbohydrate by Anthrone Method, Protein by Bradford’s method, lipid by Vanillin Method and Estimation of crude fibre.

Result and Discussion

Organoleptic Evaluation of Developed Prebioticbased Mint Flavoured Instant Mix

Mean score of the acceptability of mint flavoured instant mix

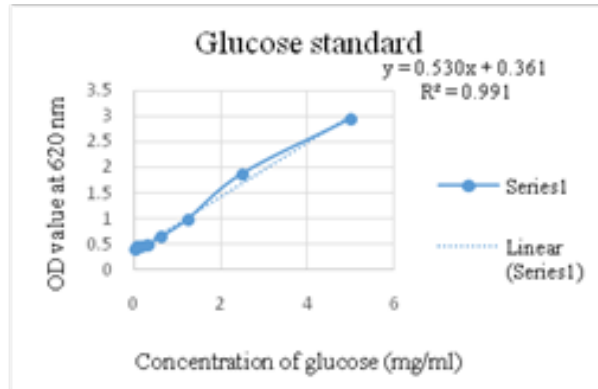
Quality Attributes	Control (ENO) T ₀	Sample (1:3) T ₁	Sample (2:2) T ₂	Sample (3:1) T ₃
Colour	7.36 ± 1.62	6.21±0.53	8.2±0.77	8.6±1.71
Flavour	6.8±1.42	6.33±1.23	7.2±0.42	8.2±0.421
Taste	6.7±1.159	6.55 ± 0.74	7.5 ± 0.55	7.6±0.84
Overall Acceptability	7.3±0.27	6.83 ± 0.57	7.4 ± 0.73	8.6±0.69

From the above table, it was found that the overall acceptability score of sample (3:1) is 8.6±0.69 hence, it has high level of acceptance.

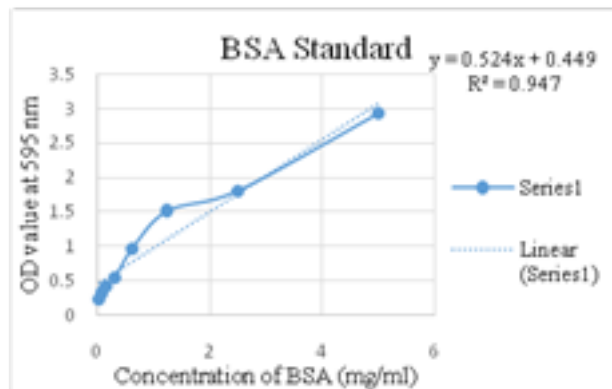
Nutrient Analysis of Developed Prebiotic Product

Healthy food refers to the food that contains the right amount of nutrients to keep our body healthy. Hence, the nutrient content such as Carbohydrate, Protein, Fat, Fibre content were studied for the developed product and it resulted in good amount of nutritional value to keep away long-term illness and get rid of all harmful things.

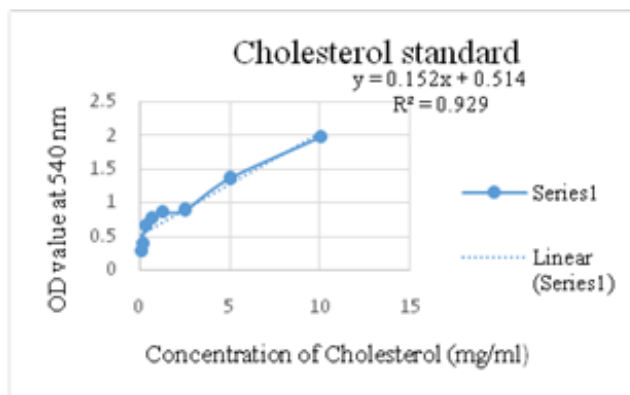
1. Carbohydrate content was estimated using Anthrone Method.



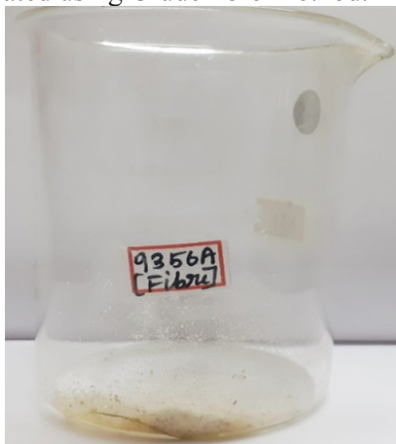
2. Protein content was estimated using Bradford's Method



3. Fat content was estimated using Vanillin Method.



iv. Fibre content was estimated using Crude fibre Method.



Crude fibre = 50%

Nutritive Value Calculation for Developed Novel Food Product (per 100g)

Ingredients	Quantity	Cho (g)	Protein (g)	Fat (g)	Fibre (g)
Sunflower Seeds	30g	2.06	7.06	15.56	3.24
Flax Seeds	10g	1.1	1.86	3.57	2.62
Lemon Peel Powder	20g	1.39	0.08	0.15	0.34
Ginger Powder	20g	1.79	0.44	0.17	1.07
Mint	20g	0.48	0.93	-	1.18
Total	100g	6.82	10.37	19.45	8.45

The carbohydrate content was found to be 6.82 (g), the protein content was found to be 10.37 (g), the fat content was found to be 19.45 (g) and fibre content was found to be 8.45 (g).

Conclusion

High-fiber foods such as fruits, vegetables, and grains reduce acid reflux due primarily to fiber qualities as a digestive aid. Fiber among other things, absorbs liquid in the digestive system, which prevents the displacement of stomach acid. For this reason, sources of soluble fiber, such as sunflower seeds are especially beneficial reducing inflammation and other digestion related problems and on the other hand, the insoluble fiber present in flax seed can help relieve or prevent constipation and keep your bowel movements regular. Small amounts of lemon when added to water can have an alkalizing effect on the digestive tract. This is helpful because it can help to counteract the acidity that is produced by GERD and acid reflux. Using ginger for acid reflux is a great way to treat this condition naturally, without any strong medication. Furthermore, it also adds extra nutrition to your daily diet.

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