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Development of high fiber and 30% reduced sugar हि-cup instant soluble tea

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Abstract
Tea is the most popular beverage of all the time. It's a part of the daily routine for many populations irrespective of the age, gender and flavour of the tea. As it is highly consumable beverage the demand for it increases. People preferred to have tea anywhere and anytime. The developed instant soluble tea powder is a fibre rich, natural ingredient used which is a healthier option and is nutrient dense with good amount of antioxidants and dietary fibres and has literature proving the benefits such as anti-inflammatory helps in throat infections, gastrointestinal infections which is also a growing problem. Along with tea powder other ingredients used are Clove, Ginger, Tulsi powder, SweetPearl and Nutriose which are also proven to have a high content of dietary fibre and other Phytonutrients like, epigallocatechin and antioxidants. The formulated product was analysed for its physical, biochemical and sensory properties. The quality was determined on the basis of physiochemical characterization such as Moisture content (2.404%), Ash content (1.045), Total fats (3.308g/100g), Protein (11g/100g), Carbohydrates (75.74g/100g), Crude fibre (6.5g/100g), along with Organoleptic analysis including the sensory attributes of colour, flavour, texture, taste and odour showed that the product was liked very much (Hedonic Rating Score-8) by the panellists. A suitable packaging for the product was selected taking into considerations the properties of the product and shelf life studies were carried out and it was observed that the product has a shelf life of 28 days from the date of manufacture. Thus, the future prospects and commercial scope for manufacturing good quality and appropriate Dietary fibre rich and low in sugar instant soluble tea powder can lead to a market ready product which is nutrient rich and safe for consumption.

Keywords: Tulsi, clove, ginger, sweetpearl, nutriose

1. Introduction

India is the largest producer and consumer of black tea in the world. All four varieties of tea (green, black, oolong and white tea) come from the same evergreen plant named Camellia Sinensis. The differences among tea varieties result from the way tea manufacturers process the leaves.Black tea is a fully oxidised tea, unlike green tea which is not oxidised. The processing of black tea involves the additional step of aeration, followed by the withering of leaves for several hours to oxidise the flavonoids. This darkens the colour of leaves from green to dark-brownish-and also gives black tea a distinctive flavor. If you like the flavor of black tea, you can consume it in a variety of ways. In India, people normally add milk and sugar to black tea, as well as herbs such as ginger, mulethi, tulsi (holy basil), cinnamon, cardamom, lemon grass, etc. Tea is the second most widely consumed beverage in the world after water. And among all tea varieties, black tea is the most widely consumed. Most people drink black tea (usually hot) for taste, alertness and energy. Black tea contains caffeine and theophylline, both of which can speed up your heart rate and make you feel more alert. There is good scientific evidence to show that drinking tea is good for health. It not only lowers blood pressure, but also increases your immunity and protects the heart, helps prevent obesity and tooth decay (among other things). The polyphenols in black tea have powerful anti-oxidant properties that enhance immunity by preventing or slowing down the oxidative damage to our body. They protect our cells and tissues from oxidative stress by scavenging on free radicals and reactive oxygen species (ROS) that are responsible for heart disease, diabetes, cancer, hypertension, etc. The raw materials used in formulating the instant tea mixture were Black Tea powder, Clove powder, Tulsi powder, Ginger powder, Roquette Nutriose® soluble fiber and Roquette SweetPearl® Maltitol [7, 11, 14, 16].

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- **Black tea powder**: Black tea is made from the leaves of a bush called *Camellia sinensis*. A process called oxidation turns the leaves from green to a dark brownish-black color. Oxidation means the leaves are exposed to moist, oxygen-rich air. Many people drink black tea for alertness and energy. There is good scientific evidence to show this works. Black tea contains caffeine. It also contains a little bit of a stimulating substance called theophylline. Both can speed up your heart rate and make you feel more alert. Black tea is also full of healthy substances called polyphenols. Polyphenols are antioxidants that can help protect your cells from DNA damage. Increasing evidence hints that the antioxidants in black tea may reduce atherosclerosis (clogged arteries), especially in women. It may also help lower the risk of heart attack and cardiovascular disease. Regularly drinking black tea may also lower your risk for these conditions: Diabetes, High cholesterol, Kidney stones, Parkinson's disease. Black tea extract is sold as a supplement. Sometimes, the supplement includes other types of herbs, vitamins, or minerals. Drinking a moderate amount of black tea (one to four cups a day) may boost blood pressure slightly, but the effect does not last long [9, 12].

- **Clove powder**: Cloves are the flower buds of the clove tree, an evergreen also known as *Syzygium aromaticum*. Found in both whole and ground forms, this versatile spice can be used to season pot roasts, add flavor to hot beverages. In addition to their sweet, aromatic flavor, cloves are known for their potent medicinal properties. In fact, animal studies have found that the compounds in cloves may have several health benefits, including supporting liver health and helping stabilize blood sugar levels, high in antioxidants, including eugenol and vitamin C, both of which can help reduce oxidative stress, promote oral health due to its antimicrobial properties, which may help kill harmful bacteria. The compounds they contain may help reduce oxidative stress and protect the liver. Help promote insulin production and lower blood sugar [13, 15].

- **Tulsi powder**: The tulsi plant (*Ocimum sanctum* or *Ocimum tenuiflorum*) is a member of the mint family closely related to culinary basil (*Ocimum basilicum*), but it is differentiated by its medicinal properties and some physical characteristics. Tulsi has been used for centuries to cure symptoms of various diseases and ailments. Combats Respiratory Ailments-Tulsi may relieve symptoms of asthma, bronchitis, colds, congestion, coughs, flu, sinusitis, sore throat, and similar ailments. Lowers Blood Pressure and Reduces Stress-Regular consumption of tulsi may lower blood pressure and cholesterol by regulating cortisol levels, reducing the risk of stroke, heart attack, and other related diseases. Treats Gastrointestinal Disorders-Tulsi can be used to treat indigestion, intestinal parasites, ulcers, vomiting, gastric disorders, and stomach or menstrual cramps. It may also reduce pain from kidney stones and could help prevent them. Relieves Arthritis-Tulsi tea may help reduce inflammation and relieve the joint pain associated with arthritis. Regulates Blood Sugar-Drinking tulsi tea can help maintain stable blood sugar levels. It may also improve metabolism and promote the efficient processing of carbohydrates and fats [10].

- **Ginger powder**: Ginger belongs to the Zingiberaceae family, and is closely related to turmeric, cardamom and galangal. The rhizome (underground part of the stem) is the part commonly used as a spice. It is often called ginger root, or simply ginger. Gingerol is the main bioactive compound in ginger, responsible for much of its medicinal properties. It has powerful anti-inflammatory and antioxidant effects. Helps in relieve nausea and vomiting after surgery, and in cancer patients undergoing chemotherapy, anti-inflammatory effects, it help with Osteoarthritis, it may drastically lower blood sugars and improve heart disease risk factors, help treat chronic indigestion, may significantly reduce menstrual pain, lower cholesterol levels, may improve brain function and protect against Alzheimer's disease and can Help Fight Infections [8, 17].

- **Roquette nutriose soluble fiber**: NUTRIOSE®'s high soluble fiber content (85%) and outstanding digestive tolerance ensure that fiber enrichment can be to the optimum recommended levels required to maintain a healthy digestive system and general well-being. It is unique source of sugar-free soluble fiber that can significantly contribute to sugar reduction, caloric valuereduction and overall daily caloric intake management also an excellent bulking agent and can be used as a sugar replacement on a 1:1 ratio in most applications. It is largely and extensively fermented all along the colon inducing a great digestive tolerance and modulation of the colonic environment [6].

- **Roquette SweetPearl® maltitol**: A natural sweet bulk sweetner produced from maze or wheat. Sugar-free bulk sweetner that has 40% less calories than sugar (Calorie value: 2kcal/g) has low glycemic response (GR: 29) have good digestive tolerance and safe for teeth. It gives gluten free pleasure [6]

2. Objective

To develop an instantly soluble tea which is fibre rich product with 30% sugar reduction which is nutrient dense and healthier as compared to other instant tea mix, which are very healthy for the body and boost the body metabolism. The ingredients used are Black tea powder, clove powder, ginger powder, tulsi powder, Roquette Nutriose® and Roquette SweetPearl® Maltitol.

- To meet consumer needs and commercially viable product following parameters are considered-
- To formulate the product through various trials to meet the sensory attributes of people over a large age group limit.
- To estimate the proximate nutritional analysis of the formulated product.
- Organoleptic and sensory evaluation.
- To select a suitable and attractive packaging material.
- To conduct stability and shelf life studies.
- Label for the product as per regulation.

3. Methodology
3.1 Materials
The raw materials used in formulating the instant tea mixture were Black Tea powder, Clove powder, Tulsi powder, Ginger powder, Roquette Nutriose soluble fiber and Roquette SweetPearl® Maltitol.

3.2 Method of preparation

Take all the required powders like Tea powder, clove powder, ginger powder, tulsi powder, Sweet Pearl and Nutrirose.

↓

Weigh the required amount of powders (as per the recommended amount) and mix well.

↓

Weigh all the ingredients mentioned above, mix and pack the product in PET/ MET PET/ LDPE packaging material.

4. Product Formulation Trials

Table 1: Different trails for formulating the product

Ingredients(g)	T1	T2	T3	T4	T5
Black Tea Powder	Extraction of black tea was not done properly	To grind black tea leaves and sieve them	10	10	10
Ginger Powder			1.5	1.5	1.5
Clove Powder			0.75	0.75	0.75
Tulsi Powder			1.2	1.2	1.2
SweetPearl			20	15	15
Nutriose Fiber			5	5	2
Conclusion			Rejected	Rejected	Accepted

Around 05 trials with different proportions of the ingredients were done before finalising the recipe of the product. The 5th trial (10g Tea powder + 15g SweetPearl + 2g Nutriose + 0.75g clove + 1.5g ginger + 1.2g tulsi. Doesn't give after taste) containing same amounts of tea powder, clove, ginger, tulsi and SweetPearl but the amount of nutriose was changed, after which it doesn't gives the after taste. This formulation was finalized. Reason for selecting fifth trial: The taste of the tea was bitter due to excess of nutriose, therefore we changed the nutriose content. After changing the nutriose content, the taste of the tea was found to be perfect, fit for consumption and safe.

Fig 1: Final Product made using final powdered mixture

5. Proximate evaluation of the product
Proximate analysis of the product was carried out by using different methods.

5.1 Estimation of moisture content
About 5.0g sample was weighed and distributed evenly over the plate for quick drying. The plates were placed in the oven for 3 hrs at 105°C.The plates were removed and cooled to room temperature in a desiccator. The plates were weighed after complete cooling and the mass obtained was recorded [1].

5.2 Estimation of ash content
It was estimated by using Muffle furnace, 5g of sample was

weighed. The sample was incinerated in the crucible until no fumes were observed. The crucible was allowed to cool and placed in a muffle furnace at 450-550℃ for 3 hours. The crucible was taken out and placed in a desiccator to cool to room temperature. The crucible with ash was weighed and the ash content was calculated [1].

5.3 Estimation of Fat by Soxhlet method
5g of sample was taken in a whatmann filter paper no. 1 and thimble was made. The prepared thimble was inserted into the extractor.100ml of petroleum ether was added to the round bottom flask. The soxhlet appratus was kept in a boiling water bath, for digestion, for 4 hours [1].

5.4 Estimation of protein content by biuret method
Weigh out approx. 0.2 g of sample add 10 ml of 0.5% SDS. Vortex the mixture for 1 minute, then centrifuge the mixture at 2500rpm for 8 minutes. The protein will be in the supernatant. Take this as sample and make the required dilutions and take the readings at 540nm [1].

5.5 Estimation of crude fiber
Crude fiber was estimated by Acid-Alkali hydrolysis method. Boil 2g of dried material with 200ml of H_2SO_4 for 30min. Filter and then boil with 200ml of sodium hydroxide solution for 30min. Filter through muslin cloth again and wash with 25ml of boiling 1.25% H_2SO_4, three 50ml portion of water and 25ml alcohol. Dry the residue for 2hours at 1800℃. Cool it in a desiccator and weigh it. Ignite for 30min at 6000℃. Cool it in a desiccator and re-weigh [1].

5.6 Determination of total carbohydrates content by weight difference method
Carbohydrate Content was determined by subtracting from 100 the sum of the values of protein (g), fat(g), crude fiber(g), moisture (%) and Ash content(g).

5.7 Estimation of Energy content
Total energy content (kcal) was determined by multiplying the Crude Carbohydrates(g), Crude Protein(g) and Crude Fat(g) by water factor 4kcal/g, 4kcal/g and 9kcal/g respectively.

6. Microbial analysis of the product
Determination of Microbial load was done by total plate count. A serial dilution of the sample is used to reduce the concentration of microorganisms in the sample. The stock sample is serially transferred with thorough mixing after each dilution step. Pour plate method was used for the estimation in which sample was mixed with the liquid Nutrient Agar and then the content was poured in the sterile petri plate for bacterial count and Sabouraud's Agar for the moulds and fungi count. Pour plate technique is used to determine the number of microbes/cm3 or microbes/g of specimen sample [2].

7. Sensory evaluation of the product
The sensory evaluation was done using 9-point hedonic scale test. In this method, 30 untrained panellists are provided with a sample and a questionnaire wherein he or she is asked to rate the attributes of the product such as taste, mouth feel, colour/appearance, odour and texture on a scale from 1 to 9. In such a way the data from each individual is collected and analysed.

8. Shelf life testing

The product was stored at room temperature in its specified packaging material and observed for one month for changes in colour, taste and any visible microbial growth. Depending on the results of the room temperature conditions the optimum storage conditions and shelf life was determined.

9. Food labelling and packaging
9.1 Packaging of the product

The principal roles of food packaging are to protect food products from outside influences and damage, to contain the food, and to provide consumers with ingredient and nutritional information (Coles 2003). Traceability, convenience, and tamper indication are secondary functions of increasing importance. The goal of food packaging is to contain food in a cost-effective way that satisfies industry requirements and consumer desires, maintains food safety, and minimizes environmental impact. The packaging of the final product was done in 'MET PET Pouches'. Metalized polyethylene terephthalate (PET) films also known as MET/PET or VMPET. They are polymeric material made by the coating of metallic thin layers on polymer films. The coating gives a reflective surface and a glowy look to the material while enhancing the barrier properties of the base polymer film extrusion. The popular metal used for coating is Aluminium. It is a versatile workhorse of a material, and is fully ready for any industrial or FDA as it is free of toxins [5].

9.2 Filling and packaging of the product
▪ After preparation of full batch, the tea mix powder was weighed for the single pouch.

▪ 10g of the product was filled in the MET PET Pouches.
▪ The pouches were then sealed with a sealing machine.

9.3 Labelling of the product

A growing awareness of the link between diet and health has precipitated a rapid expansion in the market for functional foods. Given the credence nature of functional food attributes, labelling plays a key role in allowing consumers to make informed choices about foods with enhanced health attributes. The degree, to which a particular jurisdiction permits health claims for food products, and the type of allowable health claim, influence the information set available to consumers. Food labelling for the products manufactured in India and/or manufactured for the purpose of sale in India should comply certain labelling regulations stated by FSSAI and FSSR. Certain Indian labelling regulations are listed below:[3]

Nutritional information or nutritional facts per 100g or 100ml or per serving of the product shall be given on the label containing the following:

1. Name of the food
2. List of ingredients
3. Nutritional information (Energy, Carbohydrates, Protein, Fat, Fiber, Moisture Content)
4. Label claims (Nutritional or Health Claims)
5. Veg / Non-veg logo
6. Net quantity/ Serving size
7. Instructions for use
8. Date of manufacture or packaging
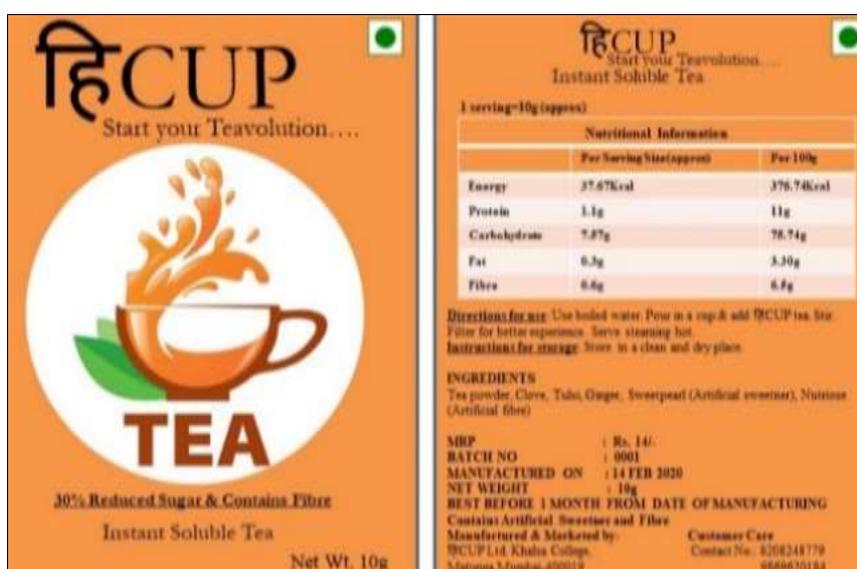9. Best before date
10. Name and address of manufacturer

Fig 2: Front and Back Label

10. Results and conclusions
10.1 Evaluation of proximate analysis

Table 2: Result of Approximate analysis

Parameters	Quantity per 100g
Energy(kcal)	376.74
Moisture (%)	2.40
Carbohydrates(g)	75.74
Crude Fibre(g)	6.5
Protein(g)	11
Fat (%)	3.31
Ash(g)	1.04

10.2 Evaluation of microbial analysis

The total viable count of the product was done using pour plate method. According to WHO guidelines, the limit for bacterial growth is 10^7 CFU/ g whereas fungal growth is 10^5 CFU/ g. The total bacterial count was found to be 48 x 10^4 CFU/ g, which falls within the limits while the total fungal count was found to be 40.67 x 10^5 CFU/ g which also is within limits, the product is safe for consumption.
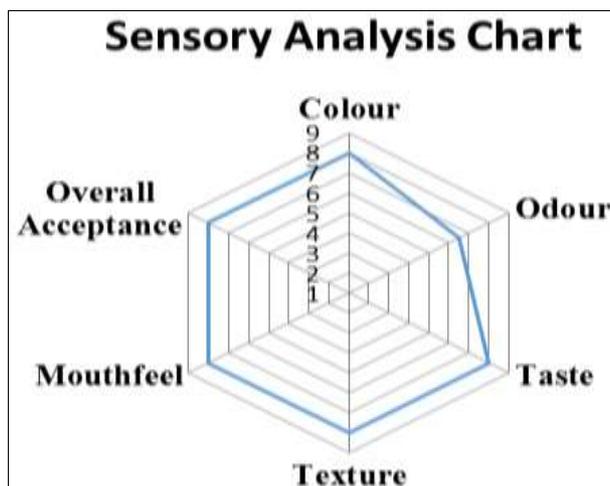
10.3 Evaluation of sensory analysis

Fig 3: Result of sensory evaluation (Radar diagram) rating scale

11. Conclusion

The product development was completed by performing various proximate and nutritional analysis, with microbial and shelf life studies. From the results, it is evident that the product is rich in dietary fibre, low in carbohydrates, and contains moderate amounts of proteins and fats. The nutritional analysis for carbohydrate content was found to be 75.74g/ 100g (According to FSSAI the maximum usage levels per day for use as a health or food supplement for an adult usage levels: 50-100 g) [4], rich in fiber having 6.5g/100g (According to FSSAI regulations for advertising and claims, 2018, the product must contain at least 6g of fiber per 100g of solids) [4] and contains less amount of fat. The product has a shelf life of one month. From the Microbial Analysis, it was evident that the product showed microbial growth of 48 x 10^4 CFU/g and fungal growth of 40.67 x 10^5 CFU/ g at Room temperature and were found to be within limits. A feedback obtained by the sensory analysis showed that the product was 'liked very much' (Hedonic Score-8) based on the attributes of colour, taste, texture, mouth feel and odour. MET PET pouches were used for packaging and a label was formed in compliance with the FSSAI regulation has made the product almost ready to be presented in the market. Thus, from all the results it can be concluded that the formulated product is not only rich in dietary fibre but also has other nutritive qualities and reduced sugar content. The product thus developed can be acceptable as a part of the daily diet of consumers owing to the health benefits it imparts.

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