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Formulation and Evaluation of a Dragon Fruit- Infused Soya Milk Protein Shake with Mango and Orange for Nutritional Enhancement

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ABSTRACT

This study focuses on the formulation and evaluation of a dragon fruit-infused soya milk protein shake enriched with mango and orange for enhanced nutritional and sensory appeal. Dragon fruit (Hylocereus spp.), known for its high antioxidant content, vitamin C, and fiber, was combined with soya milk, a rich source of plant based protein and isoflavones, to create a functional beverage. Mango and orange were incorporated to enhance the flavor profile and nutritional value, contributing natural sweetness, vitamin A, and additional vitamin C. The protein shake was formulated using optimized ratios of dragon fruit puree, soya milk, mango pulp, and orange juice. Key parameters, including nutrient composition, sensory attributes, and

stability during storage, were analyzed. Proximate analysis revealed a balanced composition of protein, carbohydrates, and dietary fiber, with significant levels of antioxidants and vitamins. Sensory evaluation conducted using a nine-point hedonic scale demonstrated high consumer acceptability in terms of taste, color, and texture. The product also underwent physicochemical analysis, including pH, viscosity, and color stability, to assess its storage properties over a 14 day period under refrigerated conditions (4°C). The results highlighted excellent stability with minimal nutrient degradation and acceptable sensory quality over time. This dragon fruit-infused soya milk protein shake presents a nutritious and innovative plant-based beverage option, appealing to health-conscious consumers seeking functional foods. The study concludes with potential recommendations for commercialization and further exploration of variations using other tropical fruits and plant-based proteins.

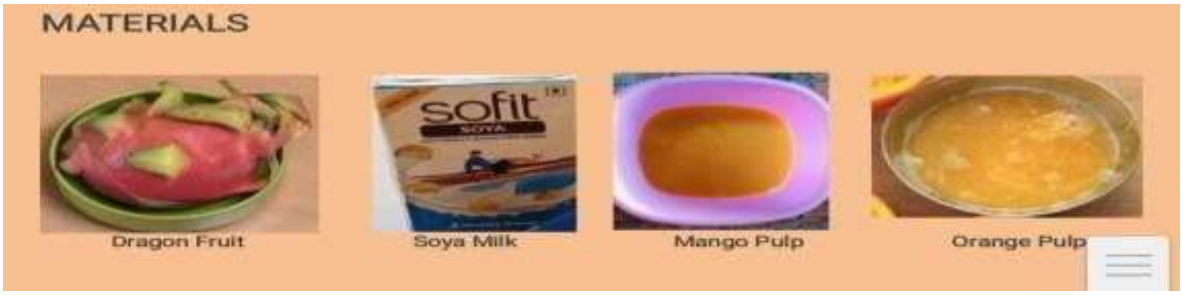
Keywords: Dragon fruit, Soya milk, Mangos, Oranges, Milk shake

INTRODUCTION

In today's health-focused world, protein shakes are increasingly popular among gym-goers, athletes, and people aiming for weight loss or muscle gain. A protein shake is a drink made by blending protein powder with water, milk, or juice. Many add fruits, vegetables, nuts, or seeds to enhance taste and nutrition. Protein is an essential macronutrient involved in building and repairing muscles, producing enzymes and hormones, and supporting overall bodily functions. While protein can be obtained from foods like legumes, dairy, and grains, protein shakes offer a quick and convenient alternative, especially for busy individuals. Protein powders are available in various types like whey, casein, soy, pea, and rice. Whey protein, derived from milk, is fast-digesting and commonly consumed after workouts. Plant-based proteins are ideal for vegetarians and vegans. When taken post-exercise, protein shakes aid muscle recovery, reduce soreness, improve satiety, and support immune health. Research shows that protein shakes increase muscle anabolism if consumed immediately after workouts. Some formulas containing added amino acids and glucose-rich carbs are more effective than plain protein powders. Vietnam is a leading producer due to its favorable climate, with pitaya cultivation supporting economic growth in rural areas like the Mekong Delta, even under climate change stresses like drought and salinity. Dragon fruit has a scaly, leather-like exterior and sweet or sour pulp that can be red, white, or yellow, depending on the species. In Vietnam, it's a key agricultural product with commercial and nutritional value. A recent study aimed to identify three well-adapted dragon fruit species in the Andaman and Nicobar Islands through morphological, biochemical, and molecular (14 ISSR primers) characterization. Significant genetic variation was observed, especially in peel/pulp color and cladode traits. DGF3 showed high carotenoid content, DGF4 high β-carotene, and DGF2 high xanthophyll levels. DPPH and ABTS tests confirmed high antioxidant activity, especially in the peels. Molecular analysis with 14 ISSR primers produced 178 bands, with polymorphism ranging from 20.0–92.8%. The highest polymorphic information content was 0.91 (UBC 856). Clustering based on ISSR markers revealed clear separation by pulp color and geography. Genotypes like DGF2 and DGF4, rich in carotenoids, could serve in nutraceutical development to combat vitamin A deficiency. Dragon fruit's origin traces to southern Mexico and Central America. Introduced to Indochina by the French around 1860, it is now grown in tropical and subtropical regions worldwide. The Seri people of Mexico still harvest wild pitayas, calling them "ziix is capxl," meaning ―thing whose fruit is sour.‖

Materials and Methods

Soya Milk, Dragon Fruit (Pitaya), Mango, Orange, Optional Additives: Natural sweeteners like honey or stevia, functional ingredients such as flaxseeds, and stabilizers if required for consistency



Methodology

FLOWCHART OF DRAGON FRUIT MILK SHAKE:

1. **Selection and Preparation of Ingredients**

- Select fresh, ripe dragon fruit, mango and oranges
- Extract dragon fruit pulp and strain if necessary
- Extract mango pulp and orange juice separately
- Measure soya milk and sweetener

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2. **Blending and Mixing**

- Blend dragon fruit pulp, mango pulp and orange juice together for 30-60 sec.
- Add soya milk gradually while stirring to prevent curdling
- Add natural sweetener and mix well

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3. **Homogenization (Optional , for better texture)**

- Process at 4000-6000rpm for 1-2 minute to ensure a smooth consistency

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4. **Heat treatment (For shelf life option)**

- Pasteurization : Heat at 85c second, then cool immediately to 4c
- This destroys spoilage micro organisms and extends shelf life

↓

5. Packaging (For Shelf life option)

- For freh consumption tore in food – grade glass/ plastic bottle at 4c for up to 2 days
- For extended shelf life (15- 30 days):
- Aeptic packaging: Fill in pre- sterilized tetra packs or glass bottles undwe sterile conditions

6. Storge and Distribution:

- Refrigerated (4c)fresh for 2 days
- Aseptic packaging (if done correctly):upto 15-30 days at room temperature

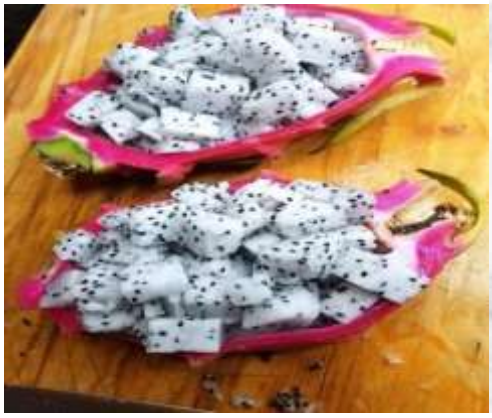

Fig No:3A Dragon fruit

Fig No: 3B Orange pulp

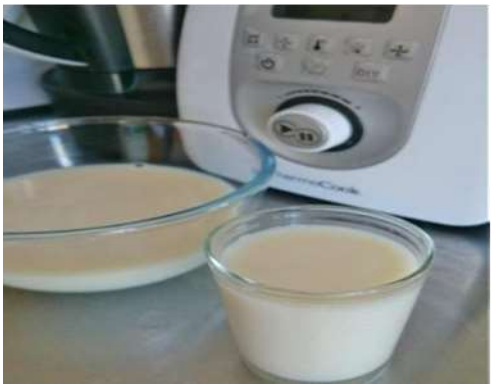

Fig No: 3C Soya Milk.

Fig No: 3D Mango Pulp

INGREDIENTS	VARIATION - 1	VARIATION -2	VARIATION -3
SOYA MILK	120ml	250ml	300ml
DRAGON FRUIT PULP	50gm	60gm	80gm
MANGO PULP	20gm	40gm	60gm
ORANGE JUICE	15ml	15ml	15ml
STEVIA	3gm	5gm	5gm
WATER	50ml	50ml	50ml

PHYSICO-CHEMICAL ANALYSIS:

Determination of Moisture:

The moisture content of optimized sample and control were determined. With the help of moisture content water activity of the product can be estimated [19]. The empty moisture cans and lids were dried in the oven at 105°C for 3 hours and transferred to the desiccator to cool. The weight of cans with lids were taken. About 5 g each of optimized variation and control samples were weighed to the dishes, and samples were spreaded uniformly. The petridishes with samples were placed in the oven for 3 hours. After drying, the dishes with partially covered lids were transferred to the desiccator to cool. Finally, the petridish with samples were reweighed.

Determination of Fat (%):

Fat content present in optimized variation and control were determined by Gerber method [20].

Fat content of the optimized variation and control was determined by the Gerber method. Use the10 ml acid pipette to transfer 10 ml of sulphuric acid into the butyrometer. Fill the 10.75 ml

pipette with milk and deliver the sample into butyrometer. Add 1 ml of amyl alcohol using the 1 ml pipette and close. Shake the butyrometer in the shaker stand until no white particles are seen and invert it a few times. Put the butyrometer in the water bath for 5 min. Take it out and dry with a cloth, put it in the centrifuge, placing two butyrometers diametrically opposite, centrifuge at maximum speed for 4 minutes. Transfer the butyrometers, stoppers downwards into water bath for 3-10 minutes. Bring lower end of fat column on to a main graduation mark by slightly withdrawing stopper. Fat reading was noted on butyrometer reading.

Determination of titrable acidity:

Acidity of optimized product and control were determined by titrable acidity method [21].

Standard Sodium Hydroxide Solution – 0.1 N. Phenolphthalein Indicator – Dissolve 1.0 g of phenolphthalein in 100 ml of 95% ethanol. Add 0.1 N NaOH solution until one drop gives a faint pink colouration. Dilute with distilled water to 200 ml. Weigh accurately about 10 g of the optimized variation and control in 2 beakers. Add 1 ml of phenolphthalein indicator. Shake well and titrate against standard NaOH solution. Titration was carried out till end point as appearance of pale pink colour. Complete the titration in 20 seconds. End point was noted and calculated.

Determination of Total soluble solids (TSS or °Brix):

Total soluble solids are an important parameter of a food product. It defines the amount of soluble solids in a given sample. It can be measured by using hand-held refractometer or a digital meter. This parameter then helps the point of maturation of the product during production. The correct TSS during production helps in setting critical control points to get food products of uniform quality. This refractive index then also can be used to assess the purity or authenticity of the product [22]. TSS of optimized variation and control were determined by using hand-held refractometer. The surface of the prism of hand-held refractometer was cleaned with ethanol where sample has to be placed. Take the sample and place the sample on the prism of refractometer. Ensure that the sample spreads evenly across the prism surface. Gently close the lid of the refractometer to evenly distribute the sample and remove any

excess air bubbles. By focusing on the line of demarcation brix of the optimized product through the eye piece of hand refractometer. Reading on the scale where the line of demarcation falls was observed. Brix value readings of optimized variation and control were noted.

Ph:

The pH content of milk shake typically ranges between 6.0 and 6.5. This makes milkshake slightly acidic, which is due to the presence of ingredients like milk and cream that contain lactic acid. The pH can vary slightly depending on factors such as the recipe, the processing methods used by the manufacturer, and any added ingredients or flavorings. The acidity can affect the perceived sweetness and creaminess of the milk shake It also plays a role in food safety and shelf stability, as lower pH levels can inhibit the growth of harmful bacteria.

Monitoring pH content in milk shake production ensures consistency in flavor, texture, and safety. It's important for manufacturers to maintain appropriate pH levels to meet regulatory standards and ensure product quality.

PROTEIN:

The protein content provides information about the nutritional profile of the milk shake made with dairy products like milk and cream naturally contains protein derived from these ingredients. Protein can contribute to the feeling of fullness or satiety after eating. milk shake with higher protein content may help satisfy hunger more effectively than those with lower protein content. The protein content can reflect the quality and type of ingredients used in the milk shake. Higher protein content might indicate the use of richer dairy ingredients or additional sources of protein, such as added milk solids or protein isolates. For individuals following specific diets, such as those focused on increasing protein intake or managing carbohydrate consumption, knowing the protein content in milk shake can be important for making informed choices.

RESULTS AND DISSCUSION

Table.no:5.1.1. results of sensorial analysis

Sensory attributes	Control	**Variation-1**	Variation-2	Variation-3
Colour	9	**8**	8	7
Taste	9	**9**	8	7
Appearance	9	**9**	9	8
Flavour	9	**8**	8	7
Texture	9	**8**	8	7
Overall acceptability	9	**9**	8	7

As per sensorial analysis variation-1 was optimized among three variations, because variation-

1 got highest overall acceptability compared with variations 2 and 3 because of appreciable colour, flavor, taste, texture and appearance. Overall acceptability score of variation-1 was nearer to the control. Colour of optimized product (1) got highest score than variations 2 and 3, and nearer to control. Firstly consumer appetizing for food is stimulated or dampened by its colour. It is the visual sensory attribute, it attracts consumer towards the food product.

TABLE.4.1.PHYSCIO-CHEMICALANALYSIS

S.NO	PARAMETERS	CONTROL	OPTIMIZED VARIATION
1	Moisture%	53.84	53.27
2	Fat%	8.77	9.22
3	Acidity%	0.32	0.29
4	Ph	6.29	6.19
5	Fiber%	0.7	18
6	Protein%	2.5	4.32
7	Carbohydrate%	26.78	26.65
8	Over run%	31.65	28.09

In the context of milk shake, protein plays a significant role in both nutritional profile and sensory attributes. According to the results, protein content of both milk shake was slightly variable. As the novel product formulations contains plant based products rather than chemicals ad artificial additives. The carbohydrate content of milk shake plays a vital role in its nutritional composition and its impact on dietary preferences. The CHO content in milk shake and the conventional dairy milk shake has a significant difference. The carbohydrate content is comparatively high in the milk shake formulated than traditional dairy milk shake. The higher carbohydrate content due to the addition of natural sugars than takes centre stage differing from the conventional milk shake.

CONCLUSION

A milkshake is a creamy dessert made by blending cream, milk, sugar, and various flavorings such as fruits, nuts, or chocolate. The churning process during freezing incorporates air, giving it a smooth texture. Traditionally enjoyed in cones, cups, or as dessert toppings, milkshakes are rich in protein, fats, carbohydrates, and essential minerals. They also serve as probiotic carriers and are suitable for individuals with stomach or throat issues. However, their high sugar and fat content can pose health risks. With the growing trend toward health and nutrition, a recent study developed a soy-based milkshake as a healthier, cholesterol-free alternative. This formulation was evaluated for flow behavior, nutrition, and sensory qualities like taste, texture, and overall appeal. The product also aligns with eco-friendly values and health-conscious lifestyles. Marketing strategies, including social media campaigns, were proposed to attract health-focused, allergen-sensitive, and environmentally aware consumers.

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