Development and Organoleptic evaluation of iron rich pancake premix using spirulina and super flours

Abstract

Since ancient times, poor nutrition has been the primary culprit of iron deficiency, especially in the school going adolescent girls. There may be a number of factors that contribute to this. The production of affordable, wholesome, and practical foods is a challenge for the food industry. Spirulina platensis, a microscopic and filamentous cyanobacterium is a blue-green algae that is considered to be one of the ancient life forms on Earth. To increase the nutritive value and to provide other vital nutrients, best wholesome cereals must be chosen over or in combination with refined flour. Here, quinoas, soy flour and amaranth come in the picture. The preparation of pancake premix and the final product was done in the department of food and nutrition , school of home sciences , BBAU Lucknow in the duration of nine months from September 2023 to May 2023. The assessment was successful and yielded genuine beneficial outcomes. The spirulina pan cakes excel in terms of flavour, aroma, and mouthfeel. The panellists found the pancake's green tint to be somewhat objectionable.

Key words

Spirulina, Quinoa, Soy flour, Amaranth, Pancakes, Sensory evaluation

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1. Introduction

Since ancient times, poor nutrition has been the primary culprit of iron deficiency, especially in the school going adolescent girls. There may be a number of factors that contribute to this, but the main ones are poverty, ignorance, unavailable supplies, faulty cooking techniques, individual interests etc. As a result, it is essential to find a way to meet the nutritional needs of the population in some way. The production of affordable, wholesome, and practical foods is a challenge for the food industry. Cyanobacteria are now widely farmed, and thus represents an economically feasible supply of nutrients such as protein, iron, and other minerals that can help meet dietary demands. It also allow the production of additional products. Spirulina has high concentrations of proteins, essential amino acids, vitamin B (notably B12),

electrolytes, and pigments (carotenoids, phycocyanin, and chlorophylls), as well as polyunsaturated fatty acids, including Omega-3 fatty acids and other biologically active compounds, due to which it stands out with a diverse biochemical composition and is used in food technology processes *(Colla et al., 2007; Mazokopakis et al., 2008; Oliveira et al., 2010)*. The most abundant micronutrients in spirulina are iron, manganese, zinc, and copper. (*Moreira et al., 2013)*. Compared to other foods, including carrots, which has 10 times as much beta carotene *(Mohammed and Mohd, 2011*). It also has antioxidant and anti-inflammatory properties (*Asieh Asghari ,et.al 2016*). Due to global food crisis, there has been a big spike in significance of algae production over the last half century.

Spirulina platensis, a microscopic and filamentous cyanobacterium is a blue-green algae that is considered to be one of the ancient life forms on Earth. The name comes from the filaments' spiral or helical structure. Increasing number of studies supports spirulina's beneficial effects on humans *(Borowitzka, M. A., 2009.)*. After being used effectively by NASA as a dietary supplement for astronauts on space missions, it rose to fame (*Tadros, M.G , 1988).* It modulates immune functions *(Selmi, C, et.al.,2011)* and promote the growth of intestinal micro flora as well (Kulshreshtha, et.al., 2008). The Food and Drug Administration (FDA) of the United States considers spirulina to be "Generally Recognised as Safe (GRAS)" and approves its use as a colourant and in foods such as cereals and beverage mixes. In India, Spirulina is available in powdered and tablet forms which are used as a dietary supplement only. It is easy to incorporate spirulina in food stuff in numerous ways like sweet and savoury. Pancakes are a popular food that may be readily transported and has a long shelf life if offered in premix form.

M Salehifar et.al., produced cookies with the incorporation of spirulina.

Monica Fradique et.al., successfully produced pasta by combining microalgae biomass with semolina flour.

To increase the nutritive value and to provide other vital nutrients, best wholesome cereals must be chosen over or in combination with refined flour. Also, the colour, texture, and volume have a direct impact on consumer acceptance, hence should be considered in the design of new products *(Bassinello et al. 2011; Canett-Romero et al. 2004)*. Here, quinoas, soy flour and amaranth come in the picture. These flours can be used for making pancakes and spirulina can be added into it. The food industry has a pressure to provide foods prepared with advanced ingredients, particularly when it comes to the functional food (*Falguera et al. 2012*). Quinoa, soy flour and amaranth are iron rich cereals. They contain near about 7.51, 8.29 and 9.33 mg iron per 100g

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respectively (*Indian food composition table 2017*). Quinoa can be used in baking because the starch in quinoa seeds has characteristics that are similar to those of wheat *(Gómez-Caravaca et al. 2011).* Due to increased market demand, high protein soya products can be used to reduce the incidence of malnutrition (*Whitehead RH et al, 1986)* and encourage farmers to grow more soyabean *(FAO, 2007).* Amaranth flour is also source of iron, zinc, copper and other vital dietary nutrients due to which it is considered as a superfood. It is a preferred food for consumption during space missions by NASA as well, thus astronauts eat it. Amaranth, also known as chaulai, rajgira, ramdana. It is a very common food in Indian fasting ritual as it is not actually a cereal unlike rice or wheat but it can be put into the category of 'pseudocereal.' The greens of the amaranth plant can used in dishes and salad preparations. In India amaranth leaves are used in making saag. The seeds of the plant are used as a replacement of cereal. Besides its nutritional richness, it has high satiety value too.

To bring all these superfoods in one plate at the same time, pancakes is a great breakfast options which fits right into the frame. They are easy to prepare without consuming much time, are practical and can be transported effortlessly.

There are no expert skills required for the preparation and premix makes the process more simplified.

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Although, the objective of this study was to formulate a supplementary diet for anaemia by using rich source of nutrients and to do sensory analysis of the developed product.

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2. Materials and Methods

2.1 Materials

The research was successfully completed within the duration of nine-month at the Food Science and Technology Laboratory (FSTL) of Babasaheb Bhimrao Ambedkar University, Lucknow. After planning a practical meal which stands accurately of the desirable measures, the ingredients were selected and collected from the local market and online platform (Amazon & blink it).

The proportion of each component was chosen to ensure that the product would have adequate nutrition without sacrificing flavour or texture.

2.2 Preparation of premix powder.

Various compositions were tried and tested based on the amount of nutrients calculated to manage iron deficiency out of which the best one was selected on the basis of the outcome of the product in context of flavour, appearance, mouth feel and overall texture.

To make premix powder, 30g of milk power, 20g of soy flour, 20g of quinoa flour, 5g of amaranth flour, 25g refined wheat flour and 5g of spirulina powder were combined. Sweetening was accomplished with 30g of dried dates powder and 18g of powdered sugar. 3g of baking powder and 1.5g baking soda for fluffiness were added. Also, 3g of vanilla powder was added for flavouring. The total of all the ingredients was 155.5g which is enough to prepare two pancakes per serving.

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Table 1: - List of ingredients for pancake premix

S.no.	Ingredients	Quantity
1	Milk powder	30g
2	Soy flour	20g
3	Quinoa	20g
4	Amaranth flour	5g
5	Refined wheat flour	25g
6	Spirulina powder	5g
7	Dry dates powder	30g
8	Powdered sugar	18g
9	Vanilla powder	3g
10	Baking powder	3g
11	Baking soda	1.5g
	TOTAL	**155.5g**

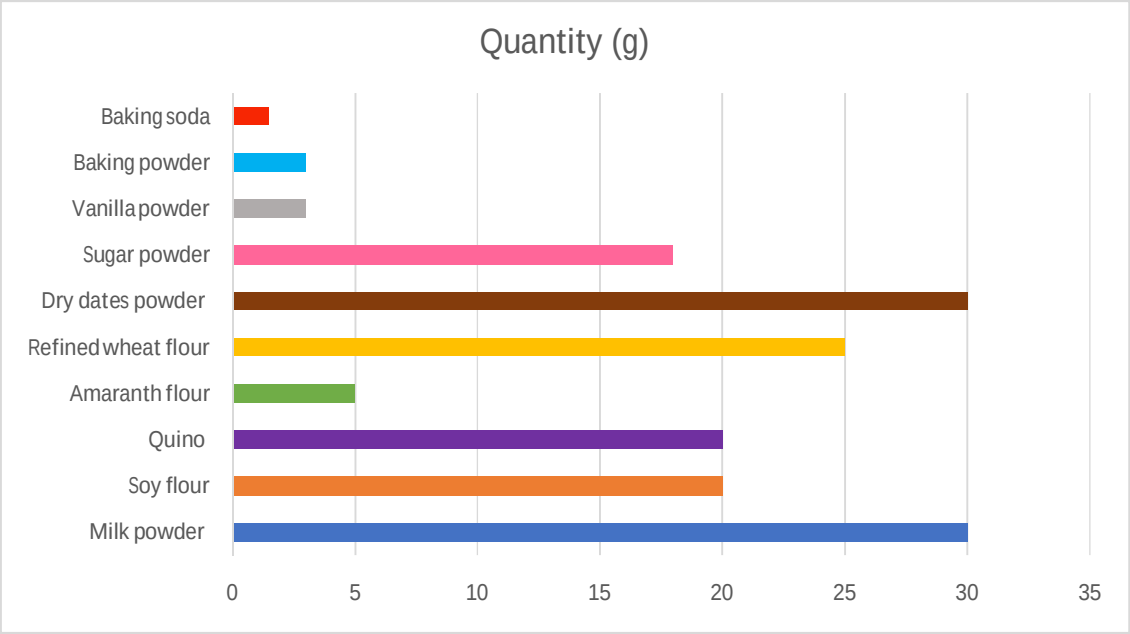

Figure 1: - Graphical representation of composition of premix powder

2.3 Preparation of pancakes

The premix was poured into a large mixing bowl. 100ml of water was added, and everything was thoroughly combined with a hand whisker to make a smooth yet thick paste-like batter. The batter was held for 15 minutes. A non-stick pan was heated on a low burner and a small amount of butter was used to grease it. The batter was poured onto the pan in a circular pattern. The pan was then covered with a lid, and the pancake was flipped, once it had thoroughly cooked on one side. The cooked pancakes were served hot with honey and butter on the top.

Pancake premix Mixing and cooking Final product

Figure 2 Preparation of pancakes

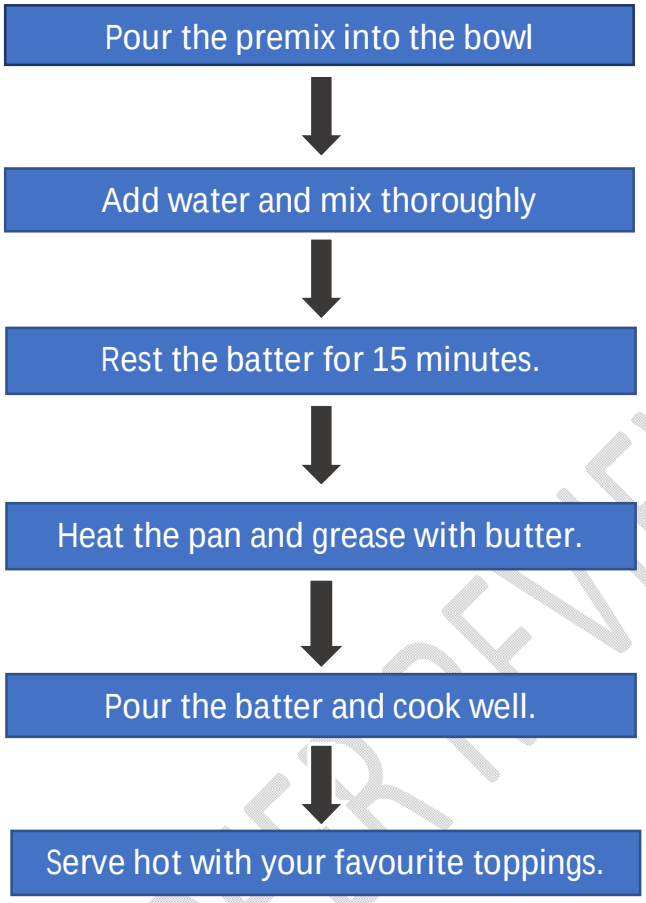

Figure 3: - Flow chart demonstrating the process of making pancakes

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2.4 Sensory Evaluation

Following the final product preparation, a sensory evaluation was conducted with 40 untrained students from Babasaheb Bhimrao Ambedkar University serving as panellists. The pancake samples were scored on a 9-point hedonic scale for flavour, fragrance, texture, appearance, and overall acceptability, as this scale illustrates and clarifies the degree of consumer acceptability and satisfaction.

Figure 4 Sensory evaluation.

The 9 point hedonic scale used for the sensory evaluation of pancakes is given below in the tabular form: -

Table 2-point hedonic scale for sensory evaluation

Score	Rating scale	Appearance / Colour	Taste/ Flavour	Smell/ Odour	Texture/ Mouthfeel
9	Liked extremely				
8	Liked very much				
7	Liked moderately				
6	Liked slightly				
5	Neither liked or disliked				
4	Disliked slightly				
3	Disliked moderately				
2	Disliked very much				
1	Disliked extremely				
Feedback Date				Signature	

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3. Result and discussion

The data acquired from the sensory evaluation of the pancake samples were analysed carefully on the basis of the ratings given by the panellists. The guests on the panel not only tasted the samples, but also critically examined them, noting their flavour, look, smell, and texture.

The assessment was successful and yielded genuine beneficial outcomes.. Results reveals that the pancakes successfully prepared with the incorporation of spirulina biomass and other uncommon grains like quinoa, amaranth and soya is relatively rich in iron and other vital nutrients which are required to treat iron deficiency anemia. Although the green colour due to spirulina biomass of the pancakes were seemed quite different but still the general sensory attributes of the pancakes was also fairly acceptable by the panel members. The result of the evaluation is given below in a tabular form: -

Table 3:- Results of sensory evaluation in percentage

Rating	Appearance/ colour	Taste / flavour	Smell/ odour	Texture/ mouthfeel
Like extremely	67.5	75	77.5	70
Like very much	30	22.5	12.5	22.5
Like moderately	2.5	2.5	10	5
Like slightly	0	0	0	2.5
Neither like or dislike	0	0	0	0
Dislike slightly	0	0	0	0
Dislike moderately	0	0	0	0
Dislike very much	0	0	0	0
Dislike extremely	0	0	0	0

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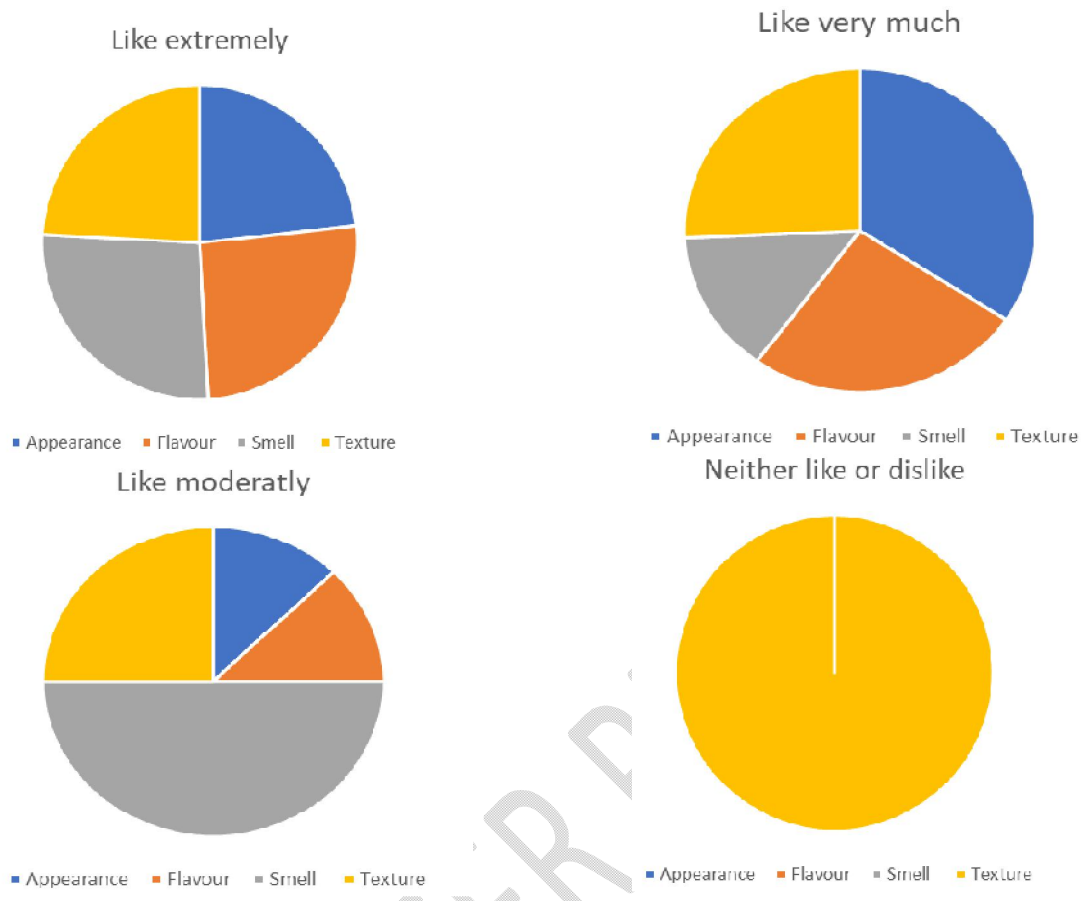

Figure 5 showing the response of the panellists

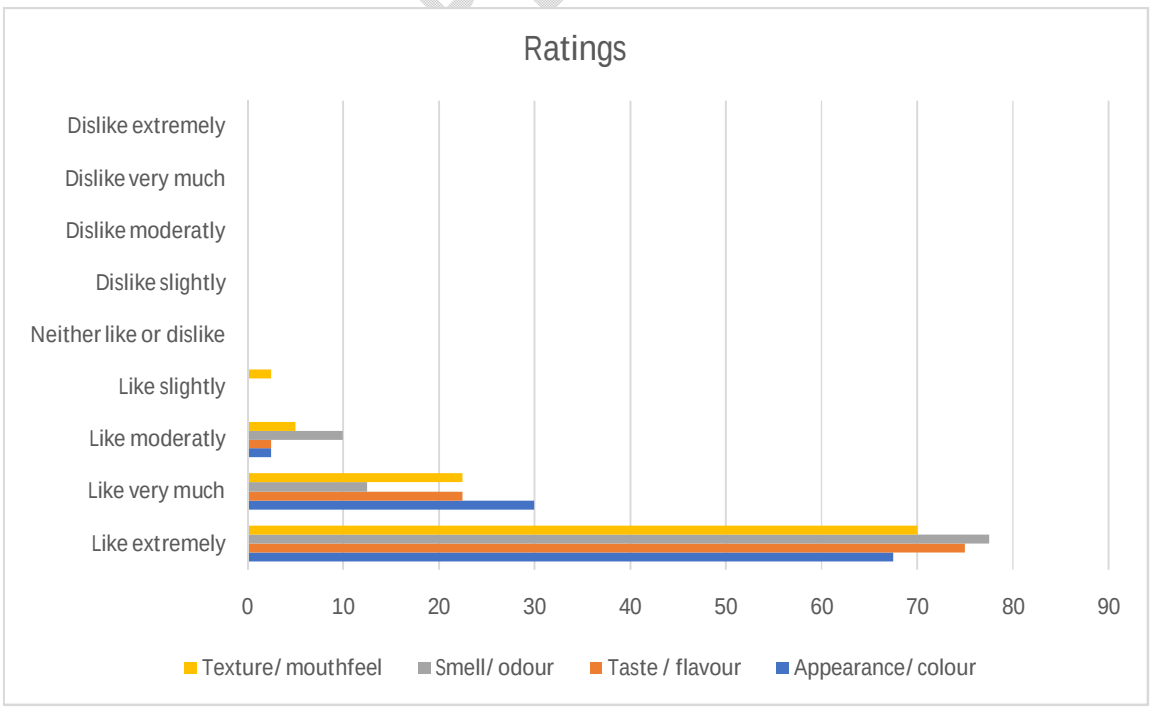

Figure 6 :- Graphical representation of sensory evaluation.

4. Conclusion

The 9-point hedonic scale which was used to check the consumers acceptability and satisfaction from every aspect showed a positive response. All 40 panel members selected from Babasaheb Bhimrao Ambedkar University were untrained and was chosen randomly hence their judgements were authentic.

After all the analyses of findings, it can be concluded the that pancakes enriched with spirulina has a favourable effect on consumers and it can be undoubtedly included in our diets to enhance the nutritive value of foods we eat in a practical way. Moreover, it will help food industries to produce variety of products in many ways.

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